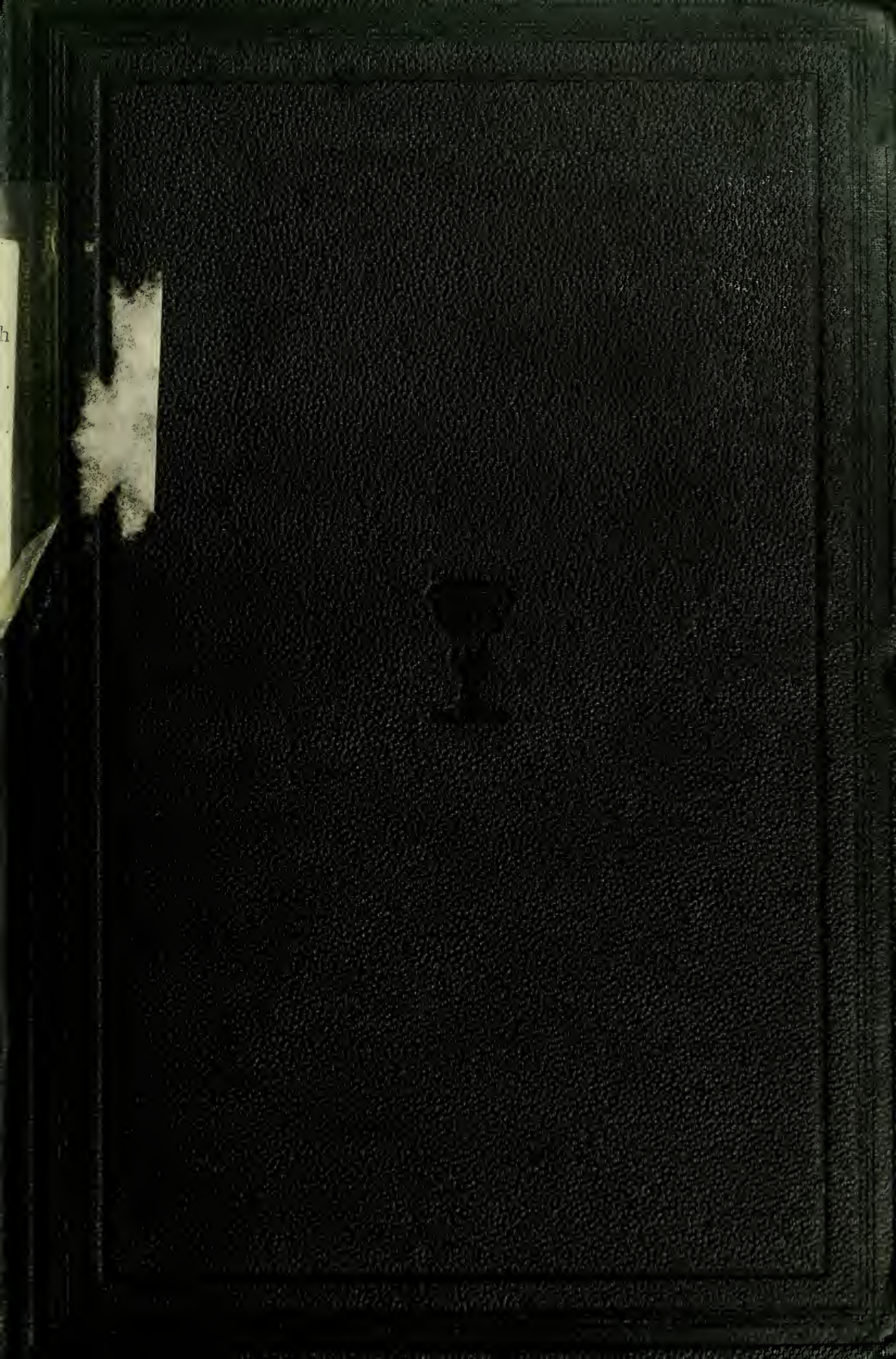
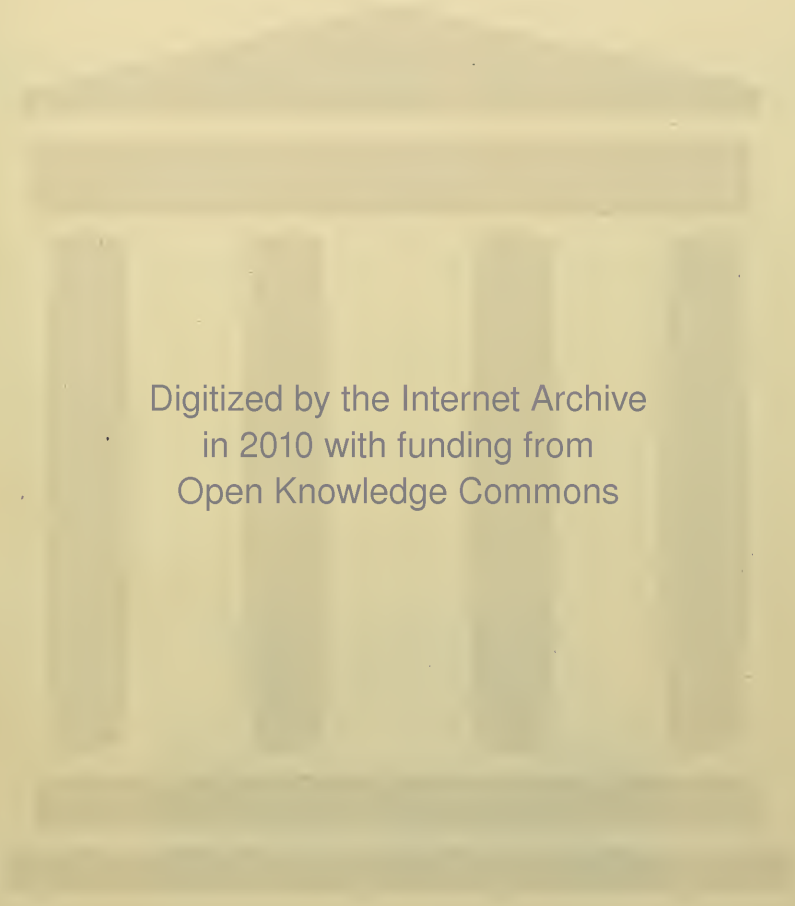




FIRST ANNUAL REPORT

OF THE

SECRETARY

OF THE

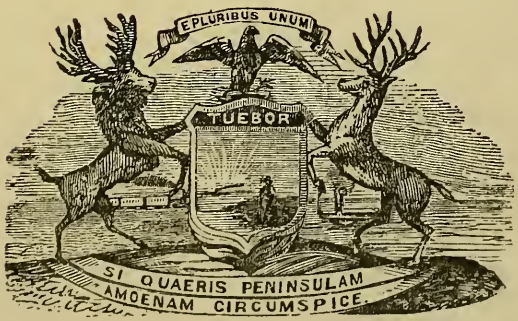
STATE BOARD OF HEALTH,

OF THE

STATE OF MICHIGAN,

FOR THE

FISCAL YEAR ENDING SEPT. 30, 1873.



BY AUTHORITY.

LANSING:
W. S. GEORGE & CO., STATE PRINTERS AND BINDERS.
1874.

STATE OF MICHIGAN,
OFFICE OF THE SECRETARY OF THE STATE BOARD OF HEALTH,
Lansing, December, 1873.

To JOHN J. BAGLEY, *Governor of Michigan:*

SIR—In compliance with the laws of this State, I present to you the accompanying Report for the fiscal year ending September 30th, 1873.

Very respectfully,

HENRY B. BAKER,
Secretary of the State Board of Health.

CONTENTS.

REPORT.

The law providing for the establishment of the State Board of Health took effect July 30th, 1873. This first Annual Report, for the year ending September 30th, 1873, is therefore for a period of only two months. The Board began its work on the very earliest day possible under the law, and notwithstanding the very short period of its existence, it is hoped that even this first report will prove of interest and value to the people.

For the purpose of giving an outline view of the legal establishment, organization, officers, and committees of the Board, and also of its labors performed and plans for the future, the papers and statements relative thereto are here submitted in the following order:

1st. The act establishing the Board.

2d. Proceedings for its organization.

3d. Names of officers and members of the Board.

4th. Titles of committees and names of chairmen of same.

5th. A statement of expenditures.

6th. The circulars issued.

7th. Some of the statistics collected.

8th. Remarks, including statements of any proceedings deemed essential to a proper understanding of the labors of the Board.

9th. Special papers on important topics connected with public health.

ACT ESTABLISHING THE BOARD.

ACT NO. 81, LAWS OF 1873.

AN ACT to establish a State Board of Health, to provide for the appointment of a Superintendent of Vital Statistics, and to assign certain duties to Local Boards of Health.

SECTION 1. *The People of the State of Michigan enact*, That a board is hereby established which shall be known under the name and style of the "State Board of Health." It shall consist of seven members as follows: Six members who shall be appointed by the Governor with the consent of the Senate, and a secretary, as provided in section four of this act. The six members first appointed shall be so designated by the Governor that the term of office of two shall expire every two years, on the last day of January. Thereafter, the Governor, with the consent of the Senate, shall biennially appoint two members to hold their offices for six years, ending January thirty-first. Any vacancy in said board may be filled, until the next regular session of the Legislature, by the Governor.

SEC. 2. The State Board of Health shall have the general supervision of the interests of the health and life of the citizens of this State. They shall especially study the vital statistics of this State, and endeavor to make intelligent and profitable use of the collected records of deaths and of sickness among the people; they shall make sanitary investigations and inquiries respecting the causes of disease, and especially of epidemics; the causes of mortality, and the effects of localities, employments, conditions, ingesta, habits, and circumstances on the health of the people. They shall, when required, or when they deem it best, advise officers of the government, or other State boards, in regard to the location, drainage, water supply, disposal of excreta, heating and ventilation of any public institution or building. They shall from time to time recommend standard works on the subject of hygiene for the use of the schools of the State.

SEC. 3. The board shall meet quarterly at Lansing, and at such other places and times as they may deem expedient. A majority shall be a quorum for the transaction of business. They shall choose one of their number to be their president, and may adopt rules and by-laws subject to the provisions of this act. They shall have authority to send their secretary, or a committee of the board, to any part of the State, when deemed necessary to investigate the cause of any special or unusual disease or mortality.

SEC. 4. At their first meeting, or as soon as a competent and suitable person can be secured, the board shall elect a secretary, who shall, by virtue of such election, become a member of the board, and its executive officer. The board may elect one of their own number secretary, in which case the Governor shall appoint another member to complete the full number of the board.

SEC. 5. The secretary shall hold his office so long as he shall faithfully discharge the duties thereof, but may be removed for just cause at a regular meeting of the board, a majority of the members voting therefor. He shall keep his office at Lansing, and shall perform the duties prescribed by this act, or required by the board. He shall keep a record of the transactions of the board; shall have the custody of all books, papers, documents, and other property belonging to the board, which may be deposited in his office; shall, so far as practicable, communicate with other State boards of health, and with the local boards of health within this State; shall keep and file all reports received from such boards, and all corres-

pondence of the office appertaining to the business of the board. He shall, so far as possible, aid in obtaining contributions to the library and museum of the board. He shall prepare blank forms of returns, and such instructions as may be necessary, and forward them to the clerks of the several boards of health throughout the State. He shall collect information concerning vital statistics, knowledge respecting diseases, and all useful information on the subject of hygiene, and through an annual report, and otherwise, as the board may direct, shall disseminate such information among the people.

SEC. 6. The secretary shall receive an annual salary, which shall be fixed by the State Board of Health. The board shall quarterly certify the amount due him, and on presentation of said certificate the Auditor General shall draw his warrant on the State Treasurer for the amount. The members of the board shall receive no per diem compensation for their services, but their traveling and other necessary expenses while employed on the business of the board shall be allowed and paid.

SEC. 7. The sum of four thousand dollars per annum, or so much thereof as may be deemed necessary by the State Board of Health, is hereby appropriated to pay the salary of the secretary, meet the contingent expenses of the office of the secretary, and the expenses of the board, which shall not exceed the sum hereby appropriated. Said expenses shall be certified and paid in the same manner as the salary of the secretary.

SEC. 8. It shall be the duty of the health physician, and also of the clerk of the local board of health in each township, city and village in this State, at least once in each year, to report to the State Board of Health their proceedings, and such other facts required, on blanks and in accordance with instructions received from said State Board. They shall also make special reports whenever required to do so by the State Board of Health.

SEC. 9. In order to afford to this board better advantages for obtaining knowledge important to be incorporated with that collected through special investigations and from other sources, it shall be the duty of all officers of the State, the physicians of all mining or other incorporated companies, and the president or agent of any company chartered, organized, or transacting business under the laws of this State, so far as is practicable, to furnish to the State Board of Health any information bearing upon public health which may be requested by said board for the purpose of enabling it better to perform its duties of collecting and distributing useful knowledge on this subject.

SEC. 10. The secretary of the State Board of Health shall be the Superintendent of Vital Statistics. Under the general direction of the Secretary of State, he shall collect these statistics, and prepare and publish the report required by law relating to births, marriages, and deaths.

SEC. 11. The Secretary of State shall provide a suitable room for the meetings of the board at Lansing, and office-room for its secretary.

ORGANIZATION OF THE BOARD.

In accordance with the provisions of the law, the Governor commissioned the following persons as members of the State Board of Health:

Homer O. Hitchcock,	of Kalamazoo.
Zenas E. Bliss,	of Grand Rapids.
Robert C. Kedzie,	of Lansing.
Charles H. Brigham,	of Ann Arbor.
Henry F. Lyster,	of Detroit.
John S. Goodman,	of East Saginaw.

The first meeting of the board was held at the office of the Secretary of State in Lansing, July 30, 1873, the following members being present: Dr. H. O. Hitchcock, Dr. R. C. Kedzie, Rev. J. S. Goodman, and Dr. Z. E. Bliss.

Dr. H. O. Hitchcock, as senior member and temporary chairman, gave the following introductory outline of the prospective labors of the board:

INTRODUCTORY ADDRESS BY DR. HITCHCOCK.

Gentlemen:—In accordance with the request of the Governor I have asked you to convene at this time, in order that, at the earliest possible day, the Michigan State Board of Health might be organized and ready for its work.

I trust it may not be considered impertinent for me to suggest an outline of the work that seems to me to have been laid upon us.

For years some of us have been laboring earnestly for the establishment of such a Board in this State. The arguments for its establishment were many and weighty, and the words free and earnest with which we urged it. As it is far easier for most people to show that *something ought to be done,* than definitely to point out *what* that *something is;* to lay burdens upon others' shoulders than to assume them themselves, so we found real pleasure in urging the preparation of a burden for *somebody's* shoulders, not stopping to think "what if it should be let down upon *our own?*" And I imagine that each one of us received a little shock one day and, for a time at least, an abatement of his zeal in the cause of Preventive Medicine, when our good Governor gently laid upon us his hand and the burden of making a State Board of Health *popular with,* because *useful to,* the people of the State.

Here, then, we are to-day, face to face with the questions, "What is the work to be done by this State Board of Health?" and "How are we to do it?"

People are accustomed to look upon the loss of life and treasure in time of war as something fearful to contemplate; one of the greatest calamities to the State. And the whole story of the State's loss by war is not told in the number of lives and the amount of treasure destroyed, but society is demoralized, families are broken up, marriages and births are prevented, the constitutions of many of the young men are broken by the hardships of the field or the hospital, and they are thus disabled to the State, and many of them transmit to their children enfeebled constitutions, susceptible to disease, thus securing that the race, so far as they are concerned, shall soon run out.

War, with all its attendant calamities, destruction of life and property, demoralization of society, and its tendency to the extinction of the race *can and ought to be averted*, and that ruler or those legislators and citizens who, by diplomacy, wise and liberal legislation, the broad and general education of the people, enable a nation to avoid it, are cherished and honored while they live, and are crowned as benefactors of their race and the world.

But war, in which this State has materially suffered, has occurred but *once* in the 36 years of her history as a State, and has therefore brought to her an average loss for each of those years, of only about 600 men, and, in round numbers, $500,000 in treasure; whereas, during those very four years of war and each preceding and succeeding one, there have been preventable causes of disease and death silently at work that have cost the State far more in lives and treasure.

According to the vital statistics of 1870, it appears that from the four principal causes of death, this State suffered a loss for that year of 3284 lives.

Is there an observant and thoughtful physician who does not believe that by the intelligent observance of all the now known principles of hygiene more than one-half the deaths occurring from consumption, scarlatina, typhoid fever, and diarrhœa, may be prevented and thus there may be yearly saved to the State 1,642 lives that are now lost from these four causes alone! And what man is there who has given any attention to the subject but is fully aware that of all the deaths occurring in the State from all other causes (7,482) there might have been prevented, to say the least, 358?

Thus, at a low estimate, there might be saved to this State, if the people were properly instructed in and would carefully observe the principles of hygiene, 2,000 lives that are now annually sacrificed by ignorance and neglect.

For every case of death it is estimated that there are 20 cases of sickness which, in loss of time, medical attendance, nursing, etc., cost, on an average, $50 each. Thus the State loses in treasure by preventable sickness $2,000,000 per annum, to say nothing of the cost of burying the dead.

But the whole of the detriment to the State is not found in the loss to its

population of those who may die, nor in the loss of the cost of the sickness and deaths that may be prevented, but a far greater detriment is to be found in the prevention of marriages and births of children by the sickness and death of those who would otherwise become parents, and especially in the enfeebled constitutions and inheritable disease entailed upon many children by diseased parents, thus imposing upon the race a tendency to run out.

Here, then, is the work for this board to do: *to educate the people in respect to the nature and causation of diseases, and the means for their prevention;* to suggest appropriate legislation for compelling, when necessary, the use of those means, and to present arguments for such education and legislation, fortified and made cogent by *facts,—well authenticated* cases of disease and death directly traceable to ignorance, neglect or disobedience of the laws of hygiene; and to make it possible by this work that many if not all of the lives and much of the treasure now needlessly lost to the State may be saved.

There is in the medical profession a whole army of noble, devoted men engaged in a hand-to-hand fight with our great enemy—*disease.* All honor to their work! But our work must not be confounded with theirs, and our reports must not seek to be receipt-books,—mere guides to the *cure* of disease.

But our Governor has made us the advanced guard of this army,—placed us on this advanced picket line that we may give warning of the very first approaches of the enemy; indeed, that we may go as scouts even into his very camp, and learning all the secrets of his strategy, may there strip him of his power by taking away the very pabulum on which he feeds.

We are indeed a small band to man so long a line; and we must call to our assistance by free and cordial correspondence all physicians and all persons throughout the State who are interested in the principles of hygiene.

We must be ready to point out the influence of the topography, geology, and climate of the various parts of our State upon the health of its citizens; the importance and intimate relation of drainage and sewerage to the health of families and whole communities; to call the attention of the people to the influence of various kinds of occupations, food, drinks, and clothing, as well as the structure of their public and private buildings, upon the development of certain forms of disease; and most especially to point out the vast importance to the welfare and the perpetuity of the State, of properly rearing, training, and educating the young; and to point out the nature and causes of epidemics, endemics, and contagious diseases, and the means for their prevention or eradication.

For success in such a work, along this whole line, well organized effort, based upon patient, intelligent research, is essential.

I bespeak from every member of this board, harmonious, earnest, faithful,

though *unpaid*, labor in this cause, and I am sure there will follow victories of grander proportions and of broader and more vital interests to mankind than any that have been or may be achieved in medicine as a strictly healing art.

In the words of one who, I venture to hope, will be chosen the secretary of this board, "Grander victories, of greater importance to the people, remain to be achieved than any which have heretofore resulted from warlike methods." "To the peaceful hero who shall call forth and so marshal facts and generalize the scattered forces of knowledge as to lead to a victory over any one of the prominent causes of death which now annually destroy our citizens by hundreds or by thousands, humanity may well accord a higher praise than to the most successful of warlike generals."

Gentlemen, I welcome you to this work, grand, self-sacrificing, and sublime.

Dr. Z. E. Bliss was appointed temporary Secretary, and the board then proceeded to ballot for a permanent Secretary. This resulted in the unanimous election of Dr. H. B. Baker of Lansing, who, after having been notified of his election, appeared before the board, took the oath of office, and entered upon his duties.

By a formal ballot, Homer O. Hitchcock, M. D., was elected President of the Board.

By-laws and rules of order were then adopted for the government of the board, relative to meetings, officers, committees, order of business, etc., thus completing its organization.

OFFICERS AND MEMBERS OF THE STATE BOARD OF HEALTH.

Homer O. Hitchcock, M. D., President, . .	Kalamazoo.
Zenas E. Bliss, M. D., ...	Grand Rapids.
Robert C. Kedzie, M. D., ...	Agr'l College, Lansing.
Rev. Chas. H. Brigham, ...	Ann Arbor.
Henry F. Lyster, M. D., ...	Detroit.
Rev. John S. Goodman, ...	East Saginaw.
Henry B. Baker, M. D., Secretary, and Supt. of Vital Statistics, ...	Office at Lansing.

COMMITTEES.

The field of labor in the cause of public health being wide beyond limit, and the members to labor in it few in number,—by way of laying out a general plan of work for the immediate future, and inaugurating a method whereby such work might be facilitated, some of the most important subjects connected with public health and life were entrusted to regular standing commit-

tees of the board, which were appointed to give special study and attention to the subjects referred to them. Each of these standing committees consists of a chairman and the president and secretary of the board. The subjects upon which standing committees are now appointed, and the names of the chairmen are as follows:

1. Epidemic, Endemic, and Contagious Diseases—Zenas E. Bliss, M. D.
2. Sewerage and Drainage—Henry F. Lyster, M. D.
3. Food, Drinks, and Water Supply—Zenas E. Bliss, M. D.
4. Buildings, public and private, including Ventilation, Heating, etc.—Robert C. Kedzie, M. D.
5. Climate, general and by season of year, and as related to age of inhabitants—Henry F. Lyster, M. D.
6. Disposal of Excreta and Decomposing Organic Matter—Homer O. Hitchcock, M. D.
7. Poisons, Explosives, Chemicals, Accidents, and Special Sources of Danger to Life and Health—Robert C. Kedzie, M. D.
8. Occupations and Recreations—Rev. Chas. H. Brigham.
9. Education,—The relation of Schools to Health, the kind and methods of Instruction in use, and methods to be proposed—Rev. John S. Goodman.
10. Geology and Topography; Influence on Health, of Forest Trees and their removal, Shade Trees near Dwellings, etc.—Rev. Charles H. Brigham.
11. The Death-Rate as influenced by Age, Climate, and Social Condition—Rev. John S. Goodman.
12. Legislation in the interests of Public Health—Robert C. Kedzie, M. D.
13. Finances—Zenas E. Bliss, M. D.

EXPENDITURES.

Amount paid for expenses of members in attending the first meeting of the board, $28.75.

The foregoing is a statement of all disbursements from the State Treasury on account of this board during the fiscal year ending September 30th, 1873.

CIRCULARS.

Very soon after the organization of the Board, Circular No. 1 was issued for the purpose of gaining certain desirable information, and with the hope of stimulating local boards of health to more active efforts in the cause of public health, and for the general purpose of placing this board in communication with the local boards of health already existing throughout the State; for whether or not such boards have ever met, or in any way performed the duties of a board of health, there is a legally constituted board of health in

every township, city, and village in this State wherever there are regularly elected township, city, and village officers, as will be seen from compiler's sections 1692 and 1740, Comp. Laws of 1871, quoted in the following circular:

CIRCULAR No. 1.

OFFICE OF THE SECRETARY OF THE STATE BOARD OF HEALTH,
LANSING, MICHIGAN, *September, 1873.*

To the Clerk of the Local Board of Health:

SIR:—Your attention is respectfully called to the following legal provisions:

Act No. 81, Laws of 1873, is "An act to establish a State Board of Health, to provide for the appointment of a Superintendent of Vital Statistics, and to assign certain duties to Local Boards of Health." In accordance with this Act, the State Board of Health has been fully organized. In entering upon its duties it asks your earnest coöperation in its labors, which have for their object the search for and removal of causes of sickness and deaths among the people. To secure your earnest and faithful action in so noble a cause, it is believed that this Board has but to point out a way in which your services will tend to aid the efforts of its members for the relief of human suffering, and the more perfect health and life of your fellow citizens and neighbors. Section 8, of Act No. 81, referred to above, is as follows: "It shall be the duty of the health physician, and also of the clerk of the local board of health in each township, city, and village in this State, at least once in each year, to report to the State Board of Health their proceedings, and such other facts required, on blanks and in accordance with instructions received from said State Board. They shall also make special reports whenever required to do so by the State Board of Health."

Section (1692) 1, of Chapter XLVI., Compiled Laws of 1871, provides that "The supervisor and justices of the peace of every township, respecting which no other provision is or shall be made by law, shall be a board of health for their respective townships, and *the township clerk shall be the clerk of such board*, and shall keep a record of their proceedings in a book to be provided for that purpose at the expense of the township." Your account for services and expenses in connection with your reports to the State Board of Health should also be allowed by your local board of health, as for services of its clerk.

Section (1740) 49, of Chapter XLVI., Compiled Laws of 1871, provides that "The mayor and aldermen of each incorporated city, and the president and council or trustees, of each incorporated village in this State, shall have and exercise all the powers and perform all the duties of a board of health, as provided in this chapter, within the limits of the cities or villages respectively, of which they are such officers."

Please fill out and return as soon as possible the enclosed blank for your first special report to this board.

It is not presumed that the clerks of local boards of health are now generally in possession of accurate official knowledge respecting "Diseases dangerous to the public health," as they should be if the provisions of Section 1735, Compiled Laws of 1871, were generally heeded. It is expected that for this report you will ascertain in some manner what are the facts, and report them as accurately as possible. For the future, it is expected that you will be prepared and make a record of all facts concerning "Diseases dangerous to the public health," which may be communicated to your board by physicians and householders, in order that at any time when called upon you may be able to report to this office a full detailed account of the cases of such diseases within the jurisdiction of your board of health.

Blanks for your Annual Report to this board will be forwarded to you in due time. It is hoped that you will then be prepared to report in full concerning your local board, whether it has or has not taken any action, and concerning the various conditions in your locality which affect the public health.

This board will at any time thankfully receive accurate and positive information concerning diseases and deaths from removable causes among the people of this State.

In case Small-pox, Scarlet Fever, Measles, Typhoid Fever, or any disease should appear in your locality as an epidemic, please make a Special Report of the fact to this office as soon as possible, in order that the conditions of its progress and decline may be thoroughly studied.

By direction of the State Board of Health.

Very respectfully,

HENRY B. BAKER, M. D.,
Secretary.

[Please preserve and file the Circulars received from this office.]

A copy of Circular No. 1 was mailed to the clerk of every township, city, and village in the State, and in the same envelope was sent a copy of the following blank "A." for a special report from such clerks acting as clerks of local boards of health, in accordance with sections 1692 and 1740, Comp. Laws of 1871, and Section 8 of Act No. 81, Laws of 1873.

[A.] [Please detach, fill out, and return this report as soon as possible.]

SPECIAL REPORT TO THE STATE BOARD OF HEALTH, BY THE CLERK OF THE BOARD OF HEALTH FOR THE *——OF —— COUNTY OF —— STATE OF MICHIGAN.

To the Secretary of the State Board of Health:

SIR:—The name of the Clerk of this *——— is ——— ———. His P. O. address is ——— County of———.

——— physician is appointed to act as health officer of this *———. The name of the health officer of this *——— is ——— ———. His P. O. address is ——— County of———.

Of the following "Diseases dangerous to the public health," there are now in this *——— cases as follows: Of Small-pox ——— cases; of Cholera ——— cases; of Scarlet Fever ——— cases; of Measles ——— cases; of Whooping Cough ——— cases; of Typhoid Fever ——— cases.

There is ——— provision by law for a Board of Health within this township † other than the one provided for in Section 1, Chapter 46, Compiled Laws of 1871. It is for the incorporated village— of ———‡. The §——— of said village—, ——— the Clerk— of said Board— of Health; and ‖———name—, ——— as follows: ——— ———. The number of incorporated villages in this township is ———.

I hereby certify that, to the best of my knowledge and belief, the foregoing report is correct.

Dated at ———, 187—.

¶———— ————,
Clerk of the Board of Health of the *——— *of* ———.

[Please fill all blanks in some way, to show that none have been overlooked.]

* Insert the word township, city, or village.
† The clerk of the board of health of each city will please forward a statement of the nature of any legal provisions, or methods of action of his board, other than those specified in Section (1740) 49, Chapter 46, Compiled Laws of 1871; such, for instance, as the delegation of the power of the city council to certain of its members, or to other persons who act as a board of health.
‡ See Compiled Laws of 1871, compiler's section (1740).—printed in the circular accompanying this blank.
§ Insert the word clerk, clerks, recorder, or recorders, if the truth can be expressed thereby.
‖ Insert the word his or their.
¶ Sign full name.

The following circular, No. 2, although dated "October," was prepared before the close of the fiscal year, and may properly be included with the circulars for 1873. Concerning the important sections of law to which it calls attention, it may be remarked that they are not new, as some have evidently supposed, but have never been generally operative, except as regards small-pox, a disease of little danger to the public compared with others named in the circu-

lar. It seems very probable that, among the thousands that die in this State every year from contagious and infectious diseases, hundreds of useful lives may be saved whenever the provisions of this law shall be faithfully carried out and local boards of health shall wisely act upon the knowledge of communicable diseases which will then be reported to them. This law will be operative as soon as an enlightened public opinion shall demand that an effort be made to save, from the liability to death, some of the many thousands who are now carelessly and needlessly exposed to the various communicable diseases. This circular, then, begins the effort to place before the people of this State such facts as, when duly appreciated, will undoubtedly result in the saving of hundreds of lives every year. It is first addressed to the physicians of this State for the reasons that they have duties to perform under the section of law to which their attention is called, they will be able sooner than others to appreciate the bearing of the facts presented, and having always been foremost in Sanitary Movements, they will undoubtedly co-operate with this board in this one. Their influence and co-operation is especially important and desirable.

CIRCULAR No. 2.

OFFICE OF THE SECRETARY OF THE STATE BOARD OF HEALTH,
LANSING, MICHIGAN, *October, 1873.*

To the Physicians of Michigan:

DOCTORS:—Your careful attention is respectfully called to the subject of Section 1735, Compiled Laws of 1871, which reads as follows: "Whenever any physician shall know that any person whom he is called to visit is infected with the small-pox, *or any other disease dangerous to the public health*, such physician shall immediately give notice thereof to the board of Health or health officer of the township in which such diseased person may be; and every physician who shall refuse or neglect to give such notice shall forfeit, for each offense, a sum not less than fifty nor more than one hundred dollars."*

By referring to the following statement of the deaths from certain contagious or infectious diseases in this State during the years 1869–70 you will be able to judge approximately as to the relative "danger to the public health" connected with these several diseases.

NUMBER OF DEATHS IN MICHIGAN FROM CERTAIN "DISEASES DANGEROUS TO THE PUBLIC HEALTH."

DISEASES.	YEAR.	
	1870.	1869.
Small-pox	9	42
Scarlet Fever	852	252
Typhoid Fever	574	437
Measles	56	147
Whooping Cough	119	158
Total	1,610	1,036

* Section 1734 provides that all householders shall give a similar notice or "forfeit a sum not exceeding one hundred dollars."

It will be seen that some other diseases are at present attended with very much more danger to life, as well as to health, than is small-pox. It is believed that very many of the deaths here recorded might have been prevented by the same means (excepting vaccination) which were generally employed in the case of small-pox. In other words, with the exception of vaccination, the same methods now employed in cases of small-pox, if applied to the prevention of these other diseases, should reduce the deaths from scarlatina, for instance, from 852 down more nearly to the number from small-pox, thus saving in each year the lives of perhaps several hundred children.

In order that the State Board of Health may study to good advantage these "diseases dangerous to public health" it will be necessary for the local boards of health to report the facts concerning them; and this they will be able to do if the physicians throughout the State will be as particular to report these diseases to the local boards of health as they have heretofore been to report cases of small-pox. Without doubt this will sometimes be quite a tax upon the time of the physician, but even during epidemics of these diseases each physician can, by using postal cards or some such method of notification, quite easily give to the local boards of health a knowledge of every case of "disease dangerous to public health" occurring in his practice. If it is proper and desirable that a fee should be paid to the physician for each case reported for record, a law should be passed providing therefor; but the provisions of the present law are imperative, and are also important to the interests of the people, and should be faithfully executed, for a central board can undoubtedly make the knowledge obtained in this manner of use in preventing sickness and deaths.

This Board desires to have a professional correspondent in every part of the State, and will, at any time, thankfully receive accurate and positive information concerning diseases or deaths from removable causes among the people of this State.

The State Board of Health having been created in consequence of the efforts of members of the medical profession, it desires and expects the earnest coöperation of the physicians of Michigan, whose sole professional business in life is the relief of human suffering, and who, more than any other class of people, are noted for their philanthropy and benevolence. It is therefore unnecessary to do more than to point out to them the fact that the knowledge which they will be able, directly and indirectly, to furnish to this Board, will eventually be of great value to the people, as it will form a part of the stock which this Board expects to collect and utilize for the prevention of diseases and deaths. Inasmuch as this knowledge is expected to be useful to the people, and costs more or less of professional time and effort, it is hoped and believed that the people will soon gladly make provision for recompensing such labor. Indeed it is hoped that the relations between the physicians and the people will eventually be so changed that instead of being paid wholly for efforts to prevent the death of diseased people, physicians will be largely employed and paid for efforts for the prevention of sickness. In the meantime it is assumed that every physician will be prompted to do even more than the law requires, and will cheerfully and promptly comply with its provisions.

Herewith please find copies of a sample blank for your use in notifying the clerks of your local boards of health. The law simply requires that you "immediately give notice" etc., but if you will add the other items suggested, it is believed you will advance the interests of public health, and merit the gratitude of the people.

By direction of the State Board of Health.

Very respectfully,

HENRY B. BAKER, M. D.,

Secretary.

[This circular is sent to every person in the State who is known at this office to be a practitioner of medicine. Any person knowing of a physician who does not receive a copy will confer a favor by sending the address of such physician to this office.]

[Form of notice recommended by the State Board of Health for the use of Householders and Physicians in complying with sections 1734 and 1735, Compiled Laws of 1871. See over.]

To the Clerk of the **_____ *of* _____ *County of* _____

State of Michigan, as Clerk of the Board of Health:

SIR:—The following persons in your **_____ have been taken sick with "diseases dangerous to the public health."†

FULL NAMES OF PERSONS.	SEX.	AGE LAST BIRTH-DAY.	NAME OF DISEASE.	TAKEN SICK.			WHETHER DIED, LIVING, OR RECOVERED.	DATE OF DEATH OR RECOVERY.		
				MONTH	DAY.	YEAR.		MONTH.	DAY.	YEAR.

So far as known, the source___of the contagious or infectious cause___of the disease _____ as follows: For case No. 1, it was_____

_____

Dated at _____, 187__

Furnished for record by _____ P. O. Address_____

*Insert the word township, city, or village.

†Includes Small-pox, Cholera, Scarlet Fever, Typhoid Fever, Measles, Whooping Cough, etc.

Sections 1734 and 1735, Compiled Laws of 1871, are as follows:

(1734.) SEC. 43. Whenever any householder shall know that any person within his family is taken sick with the small-pox, *or any other disease dangerous to the public health*, he shall immediately give notice thereof to the board of health or to the health officer of the township in which he resides; and if he shall refuse or neglect to give such notice he shall forfeit a sum not exceeding one hundred dollars.

(1735.) SEC. 44. Whenever any physician shall know that any person whom he is called to visit is infected with the small-pox, *or any other disease dangerous to the public health*, such physician shall immediately give notice thereof to the board of health or health officer of the township in which such diseased person may be; and every physician who shall refuse or neglect to give such notice, shall forfeit, for each offense, a sum not less than fifty nor more than one hundred dollars.

The subject with which this circular deals is one which should interest every citizen. The law referred to is just as binding upon every householder as upon the physician, and the penalty for its neglect by the householder may be as great as for neglect by the physician: See Section (1734.) Comp. Laws of 1871, printed to accompany the circular. Local boards of health are also required to act upon knowledge of presence of diseases dangerous to the public health; one section of Chap. 46, Comp. Laws of 1871, being as follows, italics excepted: "(1732.) Sec. 41. When the small-pox, *or any other disease dangerous to the public health*, is found to exist in any township, the board of health shall use all possible care to prevent the spreading of the infection, and to give public notice of infected places to travelers, by such means as in their judgment shall be most effectual for the common safety."

It is undoubtedly true that if all physicians and all local boards of health will perform their duties under this law the people will be much safer from communicable diseases, but the people should reflect that although local boards of health are legally bound to protect them, and receive pay for their services, physicians not only receive no pay for such work in the interest of humanity, but under present conditions their source of income is restricted by whatever lessens the number of cases of such diseases. This fact should of itself suggest the desirability of devising means for rendering it for the pecuniary interest of physicians of recognized ability to labor in the interest of the people. This pecuniary interest should be made to secure the best talent of the medical profession in the service of communities, and, besides the more important considerations, should in this way counterbalance the tendency to the unnecessary spread of communicable diseases through the ignorance of the masses and the possible carelessness of any unscrupulous practitioners. Without doubt, physicians as a class are much better qualified than are the people themselves to know the best interests of the people relative to the "diseases dangerous to the public health," and, in fact, relative to nearly all causes of disease and death. Under these circumstances it appears wise for the people not only not to allow the pecuniary interest of physicians to be antagonistic to the continuance of health in any community, but, by supporting physicians while employed at such work, to render it profitable for them to use their knowledge for the prevention of unnecessary disease. This may be done in many ways, some of which may here be suggested: If it were made for their interest, physicians could do much towards preventing disease and death by acting as lecturers and instructors in hygiene in the public schools. A general demand should be made upon our school officers that this be generally done. It is gratifying to note the rapidly increasing demand for popular lectures upon sanitary topics and those connected with the every-day welfare of the people. Sanitary journals and popular publications in the interest of public health can now be obtained, and, if generally subscribed for and read, would tend to the dissemination of useful knowledge of this kind, as do the more numerous simi-

lar publications on agricultural affairs; and these should have additional hope of support in the fact that health is important to all classes of people, while agricultural affairs are interesting chiefly to persons engaged in certain pursuits. This fact should also induce newspaper publishers to establish columns on public health, and to secure for publication useful matter bearing upon public hygiene; but it should also make editors and publishers more cautious as to the source from whence such matter emanates, and especially careful to know that what they publish is true and reliable, remembering that the subject is one connected with life and death.

By the establishment of this State Board of Health, provision is made for advice to all officers of the State, whenever it is required, relative to the location, ventilation, and water supply of public buildings, and all other questions concerning the public health. Communities, families, or persons might well follow this example, and pay for such service and advice from physicians as shall best render it possible for them to avoid the numerous causes of disease which now prevail.

One way in which physicians may be of greater use to the people than is commonly supposed is as members of local boards of health. The law very wisely provides that one physician may be so employed in every township, city, and village in the State, as will be seen by the following section of chapter 46, Compiled Laws of 1871: "(1693.) Section 2. Every board of health may appoint a physician to the board, who shall be the health officer of his township, and shall hold his office during their pleasure, and they shall establish his salary or other compensation, and shall regulate all fees and charges of every person employed by them in the execution of the health laws, and of their own regulations." If physicians know, better than non-professional persons can know, the sources of danger to the public health in the localities where they practice, it would certainly seem to follow that no board of health has performed its duty to the people who entrust their lives in its care, until it has taken measures for obtaining the counsel and advice of the best professional talent in its locality; for how otherwise can its members feel assured that there are not in their midst causes of sickness and death of which they are entirely ignorant, but of which an intelligent physician may have positive knowledge?

CIRCULAR No. 3.

OFFICE OF THE SECRETARY OF THE STATE BOARD OF HEALTH,
LANSING, MICHIGAN, *September, 1873.*

To the Clerk of the Local Board of Health:

SIR:—Herewith I send you a blank form upon which to make your Annual Report to this board for the year ending September 30th, 1873, as required by law. PLEASE FILL OUT AND RETURN THIS REPORT AS SOON AS POSSIBLE.

Also please find enclosed a form for a Record of cases of diseases which endanger the public health occurring within the jurisdiction of your board of health. By using this, or some similar form of record, you will be better able to meet the requirements of this board in

making your Annual and Special Reports required by law, which in future should include a full and exact copy of such record. A circular has been issued to the physicians of Michigan, calling attention to the law on this subject, and requesting them to use a form of notice which, if employed, will furnish facts for a record in your office similar to this plan. The law also requires all householders to give notice to the Board of Health or to the Health Officer, Section 1734 of Compiled Laws of 1871 being as follows: "Whenever any householder shall know that any person within his family is taken sick with the small-pox or *any other disease dangerous to the public health*, he shall immediately give notice thereof to the Board of Health or to the Health Officer of the township in which he resides; and if he shall refuse or neglect to give such notice, he shall forfeit a sum not exceeding one hundred dollars." The form of notice not being prescribed in the law, it is not expected that it will always be possible, from the notices which you will receive, to fill every column of your record; but so much as it is possible to learn concerning each case should be recorded, as the one fact of the number of cases of sickness from each such disease will doubtless be of value, in connection with the records of deaths, and other knowledge collected at this office.

A form of notice recommended by this board for the use of householders and physicians is enclosed herewith. *a*

By direction of the State Board of Health.

Very respectfully,

HENRY B. BAKER, M. D.,

Secretary.

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a This form of notice is not here reprinted with this circular; it was the same form as was sent out with Circular No. 2, and in this report may also be seen in that connection.

[Form of Record recommended by the State Board of Health for the use of Clerks of Local Boards of Health.] *

RECORD OF CASES OF DISEASES DANGEROUS TO THE PUBLIC HEALTH WHICH HAVE OCCURRED

RECORD NUMBER.	RECEIVED FOR RECORD.			FULL NAME OF PATIENT.	SEX.	Age last Birthday.	NAME OF DISEASE.
	Month.	Day.	Year.				
1							
2							

IN THE ..... OF ..... COUNTY OF ..... STATE OF MICHIGAN.

TAKEN SICK.			WHETHER DIED, LIVING, OR RECOVERED.	DATE OF DEATH OR RECOVERY.			PERSONS WHO FURNISHED THE FACTS FOR RECORD.	
Month.	Day.	Year.		Month.	Day.	Year.	NAME.	P. O. ADDRESS.

The reported source of Contagion or Infection was as follows: For the case recorded as No. ___ it was .....

* Sheets of such blank Record can be purchased in this city. The sheets are printed and ruled on both sides, and are the same size and of the same general style as the Assessment Blanks. A small number can be sent by mail on receipt of price and postage, or any number by express on receipt of price, which is 80 cents per quire, or $3.00 per hundred. Address W. S. George & Co., Lansing, Mich.

[Before filling any blanks, please read carefully through the entire form, including foot-notes and instructions.]

[B.]

ANNUAL REPORT TO THE STATE BOARD OF HEALTH, by the clerk of the board of health for the *——— of ———, county of ———, State of Michigan, for the year ending September 30th, 187—.

To the Secretary of the State Board of Health:

SIR:—The nature of the soil in this *——— is as follows: ———.

I estimate the number of acres of low or wet land in this *——— as follows: Swamps, —— acres; marshes, —— acres; other wet land, —— acres.

The streams, ponds, and other bodies of water in this *——— are as follows: ———.

The water is stagnant at ——— season— of the year in the following named streams, ponds, etc.: ———.

The beds of the following named streams, ponds, etc., are dry at ——— season— of the year: ———.

The natural drainage of the land in this *——— is by means of ———; the soil is —— favorable for natural drainage. The artificial drainage is as follows: ———. On the whole the drainage is †———.

During the past three years, ditches for the drainage of swamps, marshes, or other low or wet lands have been dug in this *——— to the extent of ——— rods, and the effect on the health of the people has been, for each year since, as follows: ———.

The drinking water is ‡ ———. Its quality is †———. Its source is from §———. The depth of the deepest well is about —— feet, of those having the least depth —— feet, of the greatest number of wells —— feet.

The proportion of the dwellings having cellars under them is ———. The cellars are —— wet —— at —— season— of the year.

In this *——— the proportion of the land covered with growing timber is ———.

The kinds of timber which originally grew here, stated in the order of greatest quantity, were ———.

The kinds of timber which now predominate are ———.

The principal crops raised in this *——— are ———.

The principal kinds of fruit raised in this *——— are ———.

The principal kinds of wild fruit picked in this *——— are ———.

I estimate that the proportion of the dwellings in this *———, constructed of wood, is ———; of brick, stone, etc., ———.

In the greatest number of the dwellings in this *——— the average number of rooms is ———; the average size of sleeping rooms is —— feet by —— feet; the height is —— feet.

The method of warming the greatest number of the dwellings in winter is by means of ———, and the fuel used is ———.

The greatest number of dwellings are ventilated by means of ———.

Special means of ventilation—other than by open doors and windows—have been adopted as follows: ———.

In the greatest number of cases, the average distance of the privy from the dwelling is —— feet. In the greatest number of cases the average distance of the privy from the well is —— feet. The least distance in any case is —— feet. —— deaths and —— cases of sickness have occurred in which there was a probability that the cause was the contamination of drinking water by means of privy drainage.

The number of cases in this *——— where dry earth is used (as a deodorizer and purifier) in ordinary privies is ——; in special contrivances is ——.

In ——— case— the privy or earth closet —— within or attached to the dwelling.

The principal employments of citizens of this *——— (named in order of greatest number employed) is as follows: ———.

——— deaths and ——— cases of sickness have occurred within the year, directly or indirectly traceable to occupation as a cause. The cases were as follows: ————.

In the greatest number of cases light is obtained by means of ———.

The proportion of cases where kerosene oil is used to produce light is about ———. Deaths and injuries have resulted from its use in the cases and under the circumstances as follows: ————.

Paris Green is —— employed in destroying potato bugs. ——— deaths and ——— cases of sickness have occurred which could be attributed to that poison. The evidence of death or sickness from this cause was ———.

Compared with previous years, the proportion of deaths to inhabitants in this *——— during the year ending September 30th was ———.

Compared with previous years, the proportion of sickness among the people of this *——— during the year was ———.

The greatest number of the deaths were from the diseases or causes (named in the order of greatest number) as follows: ———.

The greatest number of cases of sickness was from diseases as follows: ———.

During the year ending September 30th, 187—, cases have occurred of epidemic, infectious or contagious diseases, as follows: Of small-pox, —— cases; of cholera, —— cases; of scarlet fever, —— cases; of typhoid fever, —— cases; of measles, —— cases; of whooping cough, —— cases; of ———, —— cases.

The date of the first case of each disease was as follows: Of small-pox ———, of cholera ———, of scarlet fever ———, of typhoid fever ———, of measles ———, of whooping cough ———.

The date of the last case was as follows: Of small-pox ———, of cholera ———, of scarlet fever ———, of typhoid fever ———, of measles ———, of whooping cough ———.

Cases of epidemic, infectious, or contagious diseases now prevail as follows: Of small-pox, —— cases; of cholera, —— cases; of scarlet fever, —— cases; of typhoid fever, —— cases; of measles, —— cases; of whooping cough, —— cases.

The number of deaths during the year ending September 30th, from epidemic, infectious, or contagious diseases is as follows: From small-pox ——, from cholera ——, from scarlet fever ——, from typhoid fever ——, from measles ——, from whooping cough ——.

So far as known, the sources from which the diseases were derived were as follows: ‡‡

Of small-pox ———, of cholera ———, of scarlet fever ———, of typhoid fever ———, of measles ——— of whooping cough ———.

I attribute the ††——— in this *—— during the past year to the following causes or circumstances: ———.

In my opinion the principal sources of danger to life or health in this *—— at the present time are as follows: ———.

During the year ending September 30th the climatic conditions observed by me were as follows: ———.

During the year ending September 30th the board of health for this *——— has met as a board —— time—.

The following is a condensed abstract of the proceedings of this board during the year ending September 30th, 187—: ————.

I hereby certify that, to the best of my knowledge and belief, the statements in the foregoing report are correct.

Dated ——— 187—.

Signed, ——— ———

Clerk of the Board of Health for the *——— *of* ———.

FOOT-NOTES AND OTHER INSTRUCTIONS.

* Insert the word township, city, or village.
† Insert the words, "not good," "bad," "very bad," "good," "very good," etc. Clerks of City Boards of Health will please send a statement for their city of the details of sewerage, disposal of sewage, etc.
‡ Insert the word, "hard" or "soft."
§ Insert the word "wells," "cisterns," or state the facts if otherwise.
‡‡ After each disease insert the words, "the disease was contracted in the city of ———," "or at the school in ———," "in a room occupied by persons sick with the same disease ——— time since," "by means of clothing worn by patient with same disease," etc., etc., as the facts may be. In the case of typhoid fever, if the privy was near the well, or within the dwelling, state the facts.
†† Insert the words "excessive mortality," "excessive sickness," "general healthfulness," or otherwise express the facts.
In filling blanks followed by such words as "deaths," "cases," "feet," "rods," "acres," etc., numbers should be stated if possible, either in words or figures.
Please answer the questions as they are printed, and in the blanks left for the purpose. *Do not change or mark out any of the printed matter.* If you wish to communicate any item which will not go in the blank as printed, please write on a separate sheet of paper.
PLEASE FILL ALL BLANKS IN SOME WAY, TO SHOW THAT NONE HAVE BEEN OVERLOOKED.

The information sought to be obtained by the Annual Report of clerks of local boards of health should be such as to enable us to construct a complete physical atlas, or map of the conditions of every locality in the State. It should also give us a knowledge of the prevailing occupations, and some of the conditions as regards local practices and special dangers in the different localities. In connection with the records of deaths from various specified diseases that are now received from the different localities we ought, by comparisons and study, to ascertain under what conditions each of those diseases proves most fatal.

The Annual Reports from local boards of health should also contain detailed statements of the number of cases of "diseases dangerous to the public health" which have occurred throughout the State, of the number of deaths therefrom, the dates of first and last cases of such diseases, and the sources from which they were derived. Inasmuch as the spread of these communicable diseases is now considered to be in great part preventable, even with our present knowledge, these statements should enable us to count the cost, in lives and money, of the present imperfect methods for the prevention of sickness and deaths from communicable diseases; and should eventually show whether more active efforts bear out present beliefs and result in a much less number of cases of sickness and death from such diseases.

All these necessary questions are asked of clerks of local boards of health with the expectation that because of the importance of the subject they will, in some manner, obtain the information and answer them as the law contemplates, even though they receive no reports from physicians and householders.

STATISTICS.

In response to Circular No. 1, and the blanks sent out with it, Special Reports were received from a large number of the clerks of local boards of health. These Special Reports placed us in possession of the names and post-office addresses of the clerks of four hundred and forty-three local boards of health within this State. They also gave us, concerning a large proportion of these

local boards of health, approximate statements of the number of cases of the most common of the communicable diseases then prevailing within their jurisdiction; and they gave us some information relative to the existence and location of incorporated villages. It was not expected that perfect statistics would result from the first effort of this kind. To many of the clerks one of the subjects asked about was entirely new. They had probably never given a thought to the subject of the number of cases of contagious or infectious diseases, and did not think they could give information sufficiently near the truth to be useful. It is hoped, however, that in future they will make *some* answer to every question put to them, taking it for granted that no questions will be asked without due consideration, both as regards the desirability of obtaining an answer and the amount of labor necessary to enable the clerk to give one. It should also be distinctly understood that in cases where positive statements cannot be made, approximate ones should be given. The value of statistics of this kind is somewhat in proportion to their accuracy; but, in the absence of exact knowledge, an approximation to the truth is valuable, and frequently of great importance. It may appear to some clerks that their estimate on a certain subject would not be very near the truth, but they should remember that there is a probability that they can form estimates much nearer the truth concerning their own townships than can be formed at this office; and, without a statement or estimate from them, that is the only alternative. If, however, any of their answers are based only upon estimates, this fact should be distinctly indicated in connection with their statement.

TABLE I.—*Exhibiting, by Counties, the Number of Cities, Incorporated Villages, and Townships in the State; the Number of each of these from which a Special Report has been received; the total Number of Clerks of Local Boards of Health that have complied with the law in this respect; the Number of Health Officers reported as appointed; and the Number of cases of certain Diseases reported, in figures, as prevailing within the jurisdiction of those Boards of Health from which reports have been received.*

STATE AND COUNTIES.	Cities.		Incorporated Villages.		Townships.		Total Number of Clerks of Boards of Health that have complied with the law.	Number of "Health Officers" reported.	Cases of Diseases. [a]					
	Total Number of.	Number of Clerks that have reported.	Total Number of.	Number of Clerks of, that have reported.	Total Number of.	Number of Clerks of, that have reported.			Small-pox.	Cholera.	Scarlet Fever.	Measles.	Whooping Cough.	Typhoid Fever.
STATE	38	20	150	43	941	380	443	116	[b]22	1	85	216	968	289
Alcona	----	----	------	----	3	1	1	------	----	----	----	------	------	------
Allegan	----	----	6	2	24	13	15	9	----	----	----	12	75	14
Alpena	1	----	------	----	4	2	2	------	----	----	----	------	------	------
Antrim	----	----	------	----	9	5	5	------	----	----	----	------	1	3
Barry	1	----	2	1	16	8	9	3	----	----	----	------	47	5
Bay	1	----	3	----	14	3	3	------	----	----	----	------	------	------
Benzie	----	---	1	----	11	5	5	------	----	----	----	------	------	------
Berrien	1	----	6	3	20	7	10	6	----	----	----	15	------	------
Branch	1	1	3	1	16	4	6	3	----	----	----	------	25	------
Calhoun	2	2	3	1	20	10	13	------	----	----	6	4	30	5
Cass	----	----	2	----	15	9	9	3	----	----	2	1	------	2
Charlevoix	----	----	------	----	8	3	3	------	----	----	----	------	------	------
Cheboygan	----	----	1	----	6	1	1	------	----	----	----	------	------	------
Chippewa	----	----	1	----	3	------	------	------	----	----	----	------	------	------
Clare	----	----	------	----	5	1	1	------	----	----	----	------	------	------
Clinton	----	----	2	----	16	5	5	------	----	----	----	2	------	8
Delta	----	----	1	----	6	1	1	1	----	----	----	------	------	------
Eaton	1	1	5	2	16	8	11	2	----	----	----	------	------	10
Emmet	----	----	------	----	3	2	2	1	----	----	----	------	------	------
Genesee	1	----	4	1	18	3	4	------	----	----	----	------	------	3
Grand Traverse	----	----	------	----	10	3	3	------	----	----	----	------	------	1
Gratiot	----	----	3	----	16	6	6	2	----	----	2	12	3	4
Hillsdale	1	----	3	1	18	3	4	1	----	----	----	------	1	3
Houghton	----	----	4	1	11	3	4	2	----	----	----	4	22	29

[a] Under "Cases of Diseases," blank spaces do not indicate that there were no cases then prevailing, but only that no report was received which stated the number. The Special Reports from which this table is compiled were not all made on precisely the same day, but were in response to circular sent out in September, 1873.

[b] Includes eight cases of Varioloid.

TABLE I.—Continued.

COUNTIES.	Cities.		Incorporated Villages.		Townships.				Cases of Diseases.					
	Total Number of.	Number of Clerks that have reported.	Total Number of.	Number of Clerks of, that have reported.	Total Number of.	Number of Clerks of, that have reported.	Total Number of Clerks of Boards of Health that have complied with the law.	Number of "Health Officers" reported.	Small-pox.	Cholera.	Scarlet Fever.	Measles.	Whooping Cough.	Typhoid Fever.
Huron	----	----	------	----	23	13	13	4	1	----	----	------	50	4
Ingham	1	1	5	1	16	2	4	2	----	----	1	------	50	------
Ionia	1	1	6	3	16	5	9	4	[a]12	----	6	------	[b]45	5
Iosco	----	----	1	1	10	3	4	2	----	----	----	------	------	2
Isabella	----	----	------	----	13	6	6	------	----	----	----	------	------	1
Jackson	1	1	3	1	13	8	10	2	----	----	----	------	10	2
Kalamazoo	----	----	6	1	16	7	8	2	----	----	----	------	2	------
Kalkaska	----	----	------	----	7	3	3	------	----	----	----	------	1	6
Kent	1	1	5	1	24	15	17	5	----	----	3	------	26	26
Keweenaw	----	----	------	----	8	------	------	------	----	----	----	------	------	------
Lake	----	----	------	----	9	8	8	------	[c]	[c]	[c]	[c]	[c]	[c]
Lapeer	1	----	2	----	18	2	2	2	----	----	----	------	------	3
Leelanaw	----	----	1	----	9	6	6	1	----	----	----	------	------	------
Lenawee	1	----	7	3	22	9	12	5	----	----	3	------	21	11
Livingston	----	----	3	1	16	6	7	1	5	----	----	------	22	4
Mackinac	----	----	1	----	3	1	1	------	----	----	----	------	------	------
Macomb	----	----	5	3	14	9	12	2	----	----	----	------	127	3
Manistee	1	----	1	----	10	3	3	------	----	----	----	------	------	------
Maniton	----	----	------	----	4	------	------	------	----	----	----	------	------	------
Marquette	3	1	------	----	8	2	3	------	----	----	----	------	20	12
Mason	1	----	------	----	11	5	5	------	----	----	3	12	------	4
Mecosta	1	----	1	----	14	6	6	1	----	----	2	------	12	1
Menominee	----	----	1	----	3	2	2	------	----	----	2	------	5	15
Midland	----	----	1	----	13	9	9	3	----	----	3	23	------	------
Missaukee	----	----	------	----	5	5	5	------	0	0	0	0	0	0
Monroe	1	1	2	----	15	5	6	3	----	----	----	------	13	------
Montcalm	1	1	3	1	20	6	8	4	----	----	----	------	53	4
Muskegon	1	1	2	----	15	5	6	1	----	----	5	49	11	------
Newaygo	----	----	2	1	16	7	8	------	----	----	----	------	38	5
Oakland	1	----	8	4	25	11	15	7	3	----	----	2	59	2

[a] Includes eight cases of Varioloid.
[b] Estimated. The clerk of Boston reported "35 to 50."
[c] Returns from every township except Pleasant Plains, and reports say no cases of any of these diseases.

TABLE I.—CONTINUED.

COUNTIES.	CITIES.		INCORPORATED VILLAGES.		TOWNSHIPS.		Total Number of Clerks of Boards of Health that have complied with the law.	Number of "Health Officers" reported.	CASES OF DISEASES.					
	Total Number of.	Number of Clerks that have reported.	Total Number of.	Number of Clerks of, that have reported.	Total Number of.	Number of Clerks of, that have reported.			Small-pox.	Cholera.	Scarlet Fever.	Measles.	Whooping Cough.	Typhoid Fever.
Oceana	----	----	1	----	16	12	12	------	----	----	----	------	21	5
Ontonagon	----	----	------	----	5	------	------	------	----	----	----	------	------	------
Osceola	----	----	2	1	15	8	9	3	----	----	----	------	4	4
Ottawa	2	2	2	1	15	7	10	2	----	----	----	------	65	2
Presque Isle	----	----	1	1	2	1	2	1	----	----	----	------	------	------
Saginaw	2	1	4	1	24	12	14	5	----	1	1	------	4	5
Sanilac	----	----	1	----	23	11	11	1	----	----	----	10	16	------
Schoolcraft	----	----	------	----	3	1	1	------	----	----	----	------	5	------
Shiawassee	2	1	2	1	16	8	10	2	----	----	----	------	20	8
St. Clair	2	1	2	----	23	4	5	3	----	----	13	66	36	33
St. Joseph	----	----	5	----	16	6	6	2	----	----	4	------	3	1
Tuscola	----	----	2	----	24	11	11	2	----	----	25	------	3	12
Van Buren	----	----	5	3	18	4	7	4	----	----	----	3	1	6
Washtenaw	2	2	3	----	20	6	8	4	----	----	1	------	10	10
Wayne	2	1	4	1	18	6	8	2	----	----	3	------	9	5
Wexford	----	----	------	----	13	8	8	1	1	----	----	1	2	1

Table I. has been compiled from the Special Reports received in response to Circular No. 1. It is given not so much for any valuable statements which it may contain as for the purpose of exhibiting to those from whom we hope to obtain better statistics, some of the methods of tabulating their statements, and what are some of the most frequent defects in their answers.

The absence of figures in the columns under "Cases of Diseases" does not, in this table, indicate that there were no cases then prevailing, but only that none were reported by number. In some cases the clerks filled these blanks in such a way that it was impossible to tabulate the results. Instead of figures, which should have been employed, there were various other expressions placed before the word "cases," printed in the blank form. Examples may be given as follows: "many," "some," "yes," "cases," "few," "numerous," "unknown," "not reported," "several," "plenty." Answers to questions of number should always be given in figures, and "0" should be written where that expresses the truth, for the reason that a blank space does not necessarily mean the same

thing, but may indicate either that the question has been overlooked or that the number was unknown.

As a rule, the clerks of the new townships were more prompt and explicit in their answers than were those in the old settled counties. Missaukee county was the only one in which every township clerk fully complied with the law. Lake county was next best; returns having been received from eight of the nine townships. In Oceana county, reports were received from twelve out of sixteen townships. In Midland county, from nine out of thirteen townships. Although the name of the clerk of every township in the State is now known at this office, it is thought best not to publish in this first report the names of the townships from which no proper report has been received, and of their clerks who have not complied with the law, trusting that as soon as these officers become well acquainted with the legal requirements, they will promptly comply therewith. There seems to be no reason why we may not hereafter expect full and true reports, and proper efforts will be made to obtain such reports.

TABLE II.—*Exhibiting the Information obtained from the first Special Reports of the Clerks of the Local Boards of Health for the several Townships, Cities, and Villages in the County of Kent.*

COUNTIES, TOWNSHIPS, CITIES, AND VILLAGES.	Number of Incorporated Villages.	Names of Clerks.	Postoffice Addresses of Clerks.	Number of Health Officers.	Names of Health Officers.	Postoffice Addresses of Health Officers.	Cases of Diseases.					
							Small-pox.	Cholera.	Scarlet Fever.	Measles.	Whooping Cough.	Typhoid Fever.
Kent County	1			5			----	----	3	----	26	26
Ada	0	Joseph Hamessy	Ada	0	(No Officer.)	(No Officer.)	0	0	0	0	0	0
Algoma	----			----			----	----	----	----	----	----
Village of Rockford	----			----			----	----	----	----	----	----
Alpine	----			----			----	----	----	----	----	----
Village of Alpine	----			----			----	----	----	----	----	----
Bowne	----	Abel Ford, M. D.	Bowne	0	(No Officer.)	(No Officer.)	0	0	0	0	several.	0
Byron	0	Wm. B. Crabtree	Byron Centre	1	H. W. Strong	Byron Centre	0	0	3	0	0	4
Caledonia	----			----			----	----	----	----	----	----
Cannon	0	Thomas Noy	Cannonsburg	0	(No Officer.)	(No Officer.)	0	0	0	0	0	0
Cascade	0	Chas. F. Holt	Cascade	0	(No Officer.)	(No Officer.)	----	----	----	----	12	2
Courtland	----	Nelson Graham	Courtland Centre	1	W. T. Toplin	Courtland Centre	0	0	0	0	0	0
Gaines	0	Wm. Overholt, Jr.	Hammond	0	(No Officer.)	(No Officer.)	0	0	0	0	4	3
Grand Rapids	0	Horace D. Carpenter	Grand Rapids	0	(No Officer.)	(No Officer.)	----	----	----	----	----	2
Grand Rapids City	----	Chas. W. Warrell	Grand Rapids	1	Wm. G. Saunders	Grand Rapids	0	0	some.	0	0	few.
Grattan	----			----			----	----	----	----	----	----
Lowell	1	James H. Weeks	Lowell	0	(No Officer.)	(No Officer.)	0	0	0	0	0	1
Village of Lowell	----	James H. Weeks, R.	Lowell	----			----	----	----	----	----	----

TABLE II.—CONTINUED.

TOWNSHIPS, CITIES, AND VILLAGES.	Number of Incorporated Villages.	NAMES OF CLERKS.	POSTOFFICE ADDRESSES OF CLERKS.	Number of Health Officers.	NAMES OF HEALTH OFFICERS.	POSTOFFICE ADDRESSES OF HEALTH OFFICERS.	CASES OF DISEASES.					
							Small-pox.	Cholera.	Scarlet Fever.	Measles.	Whooping Cough.	Typhoid Fever.
Nelson	*	Brownell S. Simmons	Cedar Springs	1	Elisha F. Chester	Cedar Springs	0	0	0	0	3	7
Oakfield												
Paris												
Plainfield	0	Zerah Whitney	Belmont	0	(No Officer.)	(No Officer.)	0	0	0	0	0	5
Solon												
Vil. of Cedar Springs												
Sparta		J. Brainerd Taylor	Sparta Centre	1	Irvin J. Emmons	Sparta Centre	0	0	0	0	0	0
Village of Lisbon												
Spencer	0	Jacob Van Zandt	Spencer's Mill	0	(No Officer.)	(No Officer.)	0	0	0	0	7	0
Tyrone	0	Henry C. Wylie	Ball Creek	0	(No Officer.)	(No Officer.)	0	0	0	0	0	0
Vergennes	0	John L. Covert	Lowell	0	(No Officer.)	(No Officer.)	0	0	0	0	0	0
Walker												
Wyoming	0	Marcus H. McCoy	Grandville	0	(No Officer.)	(No Officer.)	0	0	0	0	0	2

* Part of village of Cedar Springs.

NOTE.—Throughout this table no spaces are left blank where information was received from a clerk which would enable one to fill the blank.

Table II. is printed for the purpose of exhibiting to all interested, but more particularly to clerks of local boards of health, still further details concerning the uses designed to be made of the material which they furnish. This table exhibits the manner in which all these reports throughout the State have been compiled, by the Secretary, in a manuscript volume for the uses of this State Board. If every locality in the State was fully represented, or if the reports received were all perfect, it might be desirable to print, in this report, more of this compilation, especially so much as would exhibit, for every local board, the presence, number of cases, or absence of each of the diseases mentioned. Whenever accurate reports can be obtained of all the cases of these diseases at particular seasons of the year and of all throughout the year, this information will be of great value in connection with the statistics of deaths which are now reported by supervisors, and which the law makes it the duty of this board to study in such connection. Although the result of this first effort to obtain such information from clerks of local boards of health is very far from being a complete success, as is indicated by the examples published, still it is about as successful as could be expected under the circumstances; and there is no reason why such information may not be obtained as soon as all who have duties to perform under the law shall learn the uses to be made of such knowledge, and how important it is that each one contribute their share to the growing stock of sanitary knowledge which it is expected will soon repay the effort by rendering the life and health of each one of us more secure from the numerous preventable causes of death and disease. It is but a few years since the few meteorological observers, scattered about the country, supposed themselves to be simply recording the facts of meteorology in the general interest of unapplied science. Now it is claimed that the warning given by the U. S. Signal Bureau has, in several single instances, prevented probable loss of property to the amount of more than the cost of the Bureau since its existence, saying nothing of the probable saving of human lives. It is not improbable that this same knowledge of meteorological conditions will ultimately save life in quite a different manner by being connected with other knowledge relating to diseases prevalent at certain seasons of the year, such diseases, for instance, as inflammation of the lungs. And what is true of accurate observation and record of facts in meteorology is undoubtedly true of accurate observation and record of facts in any branch of sanitary science; if this is faithfully begun and continued there can be no doubt but increased security of human life will surely result, although we may not now be able to say by what methods.

If these reports furnish a true indication of the proportion of local boards of of health which have appointed health officers, that proportion is very small. Only about one-fourth of those boards from which reports have been received have made such appointments, and it is quite probable that the proportion is not greater than that in those boards from which no report was received. It

seems to be the opinion of those who have given such subjects most study, and who ought to be best capable of judging in the matter, that all boards of health should be largely composed of physicians, or men who have made sanitary subjects a special study. In this State the law makes provision that each township board of health shall be composed of the supervisor and the justices of the peace; but it also provides that the board may choose and appoint a physician as health officer.

There are, in Michigan, between eleven and twelve hundred local boards of health. Many of them have never met or acted in any manner; many more have done nothing towards preventing sickness and deaths, but have only attended to the cemeteries and other provisions for burying the dead. The most active and best disposed of them have heretofore had, as a guide for their action, only their own experience and observation within very limited fields. It has not been possible for them to profit, to any great extent, by the experience of others, for the reason that heretofore no provision had been made for communication between different boards of health. In the work of this State Board of Health one object aimed at is the collection of the experience of all the local boards of health, with a view of collating it and publishing for the guidance of all boards in the State any useful knowledge so obtained. It must be admitted that thus far very little if any useful knowledge of this kind has been thus obtained. Model boards of health which may exist in the State have not yet generally made their existence manifest to this board; but it must be remembered that the time in which to do so has been short, and it seems altogether probable from the activity already shown by local officers in response to communications from this board that, as soon as the lines of communication shall become thoroughly established, abundant material will be received from this source, which may then be made useful to all local boards of health throughout the State.

By a resolution of this board, the Secretary was authorized to compile, for publication in this first report, so much of the statistics collected as it was possible to compile before the report was printed. The law makes no provision for a clerk to assist the Secretary in such labor, and he has found it impossible to compile the information contained in the "Annual Reports" of clerks of local boards of health in time for this report. There is valuable material in some of these reports, which it is probable will be used hereafter. But before it can be used to the best advantage, reports should be secured from the numerous localities throughout the State from which none have yet been received. If any clerk who reads this knows that he has not sent in an Annual Report for the year 1873, it is hoped he will immediately fill out the blank sent him and forward it to the office of this board at Lansing. If he has not received or has mislaid the blank, another will be sent to him on his application therefor.

REMARKS.

SPECIAL PAPERS RELATING TO PUBLIC HEALTH.

At the regular meeting of the board on October 14th, 1873, the following resolution was adopted:

"*Resolved*, That no papers shall be published in the Annual Report of this board except such as are ordered or approved for purposes of such publication by a majority of the members of the board; and that any such paper shall be published over the signature of the writer, who is entitled to the credit of its production, as well as responsible for the statements of facts and opinions expressed therein."

In accordance with this action, three special papers have been prepared and ordered published in this report, as follows: A paper on "Illuminating Oils in use in Michigan," one on "Poisonous Paper," and one on the Hygiene of School Buildings.

ILLUMINATING OILS.—As stated in "Circular No. I.," the labors of this board "have for their object the search for and removal of causes of sickness and deaths among the people." One frequent cause of death and injury to persons and property has been so manifest as to require very little search to find it. Bad oil is now a recognized source of danger, and yet its removal from our midst calls for a certain special education of all classes of the people, and this can only be effectually done by presenting them with the results of careful and accurate experiments, conducted by competent and reliable persons, sufficiently skilled in knowledge of the chemical and physical properties of coal oils to appreciate the sources of danger from their use.

Many people still class all coal oils alike, and regard them all as equally dangerous. On the other hand, many people, as no accident has ever occurred to them, think all so-called accidents the result of extreme carelessness. Prof. Kedzie shows that while some of these oils may, under any ordinary conditions, be used with safety, others may be characterized as more dangerous than gun-powder or nitro-glycerine. Prof. Kedzie's paper, published in this report, is an able treatise on a subject which so generally concerns all classes of people that it will undoubtedly be read with much interest and profit. Dr. Kedzie's labors in this connection have already attracted considerable notice to the subject, and it seems reasonable to hope will result in great good to the people by rendering life more secure in our own households and by our own evening firesides.

POISONOUS PAPER.—As Prof. Kedzie well points out, this evil still continues, and is more wide-spread than is generally appreciated, and serious results are much more frequent than is commonly supposed, even by those who have given the subject some degree of attention. Instances have lately come under

the notice of the writer, one of them since Dr. Kedzie's paper was written. In this case a child about one and a half years old untied a package brought from a store, and being attracted by a little bright green oval tag, tied to one end of a piece of goods, he put it in his mouth. His mother soon detected the mischief, took the tag away from him and the usual antidote was administered, but the child was sick and fretful for about a day notwithstanding, for the hydrated peroxide of iron given as an antidote was not freshly prepared. The pigment when tested was found to be arsenical.

If one who has become familiar with the colors which usually contain arsenical pigment, will make it a point for a short time to notice all the places where it may be seen, he will be surprised to find how generally it is employed. In ordinary green blinds the pigment is put on in oil, and is more or less permanent. Iron pumps are frequently painted green, outside and inside of the pitcher part. This may also be reasonably safe, but it looks like an unnecessary risk. The same may be said of iron grates in hot air registers, where, as in the room in the State offices in which this is written, the only fresh air supplied has to pass over a highly heated iron grate painted with paris green. In this room the inside blinds are green, as also are many of the articles supplied for daily use, and which must be frequently handled. Wherever we go we may see poisonous green pasteboard advertising cards displayed, and not infrequently we are handed tickets to concerts, lectures, etc., colored with this same poisonous pigment. In every store grass-green boxes abound, bright green tags, upon which to write the price, are attached to various articles, and green paper bands are around packages of gloves and envelopes. The fact is that this particular green is one of the most attractive colors in nature, and upon whatever article it can be readily and appropriately put, it is almost certain to be used. But perhaps the greatest amount of it is to be found at book and stationery stores where paper hangings are kept for sale. It is astonishing to see what a large proportion of the wall papers in the shops have more or less of green arsenical pigment upon them.

This is but a brief notice of a few among the hundreds of items which might be enumerated by a careful observer. In view of the extreme prevalence of such poisonous pigments, is it strange that there are so many mysterious cases of sickness where the cause seems to be past finding out? When the walls of so many rooms are covered with arsenic, is it strange that so many females who occupy them sink into a decline and die of consumption, to which disease such cases are charged? The cause of consumption itself may not be certainly known, and this may be true of about all other diseases, but so fast as causes of sickness or death are found they should certainly be dwelt upon until all are familiar with them. In his article on "Poisonous Papers," published in this report, Prof. Kedzie has thus performed good service for the people.

In view of the fact that the green colors formed by arsenical pigments are so extremely attractive to the people, it is greatly to be desired that some mate-

rial be found that will give the same color without the danger. If any inventor will accomplish this he will be a public benefactor, and merit the approbation of humanity.

The Hygiene of School Buildings.—In these days when the very foundations of our republican government are claimed to rest upon our school system which includes much of the mental training of those who are soon to be "the people" of the State, and when it is considered how much time the young spend in school buildings, that during the school ages the physical system is also being formed for life, and that upon this physical structure the intellect is dependent for its force and endurance, one may then, to some extent, realize the very great importance of any and all questions which relate to the conditions which prevail in our schools and which thus control the immediate future of the race, as well as our own happiness in the welfare of those dear to us and who are to care for us in our declining days.

The paper in this volume on the "Hygiene of School Buildings," by Prof. Kedzie, is something more than an ordinarily valuable paper. It contains much that is a positive addition to our knowledge of the subject, especially as regards the condition of the air of school-rooms as commonly constructed. It points out the essentials to the proper ventilation of school-rooms, and indicates a method by which it seems probable that this may be accomplished for ordinary school buildings.

ILLUMINATING OILS IN USE IN MICHIGAN.

BY R. C. KEDZIE, CHAIRMAN OF COMMITTEE ON POISONS, EXPLOSIVES, CHEMICALS, ACCIDENTS, AND SPECIAL SOURCES OF DANGER TO LIFE AND HEALTH.

I begin the consideration of Illuminating Oils by quoting the laws now in force in this State concerning the inspection and sale of Illuminating Oils.

Sections (1501) to (1508), Chap. 33, of Compiled Laws of 1871, as amended by Act No. 103 of Session Laws of 1873, are as follows:

An act to provide for the inspection of illuminating oils manufactured from petroleum or coal oils.

[*Approved April 3, 1869. Laws of 1869, p. 223.*]

Inspector; when Governor may appoint.

(1501.) SECTION 1. *The People of the State of Michigan enact,* In any county of the State wherein any illuminating oils are manufactured for the purpose of burning in any kind of lamp as an illuminator, or where the same is sold for that purpose, the Governor, upon the application of five or more persons, residents of said county, shall appoint a suitable person, who is not interested in manufacturing, dealing, or vending any or either of said oils,

Duties of.

whose duty it shall be to examine and test the quality of all such oils that he shall be requested to examine and test by any manufacturer, vender, or dealer; and if, upon such testing or examination, the oils shall meet the requirements hereinafter specified, he

How he shall mark barrels or casks.

shall fix his brand or device, viz.: "Approved," with the date, over his official signature, upon the package, barrel, or cask containing the same, and it shall be lawful for any manufacturer, vender, or dealer to sell the same as an illuminator; but if the oil so tested shall not meet said requirements, he shall make in plain letters on said package, cask, or barrel, over his official signature, the words, "Rejected for illuminating purposes," and it shall be unlawful for the owner thereof to sell such oil for illuminating purposes.[1]

Inspector to provide necessary apparatus.

(1502.) SEC. 2. It shall be the duty of the inspector to provide himself, at his own expense, with the necessary instruments and apparatus for testing the quality of said illuminating oils, and, when called upon for that purpose, to promptly inspect all oils hereinbefore mentioned, and to report as dangerous all oils which, at the temperature of one hundred and fifty degrees of Fahrenheit's thermometer, will emit an explosive gas or take fire on applying thereto or plunging therein a well-lighted match: *Provided,* The quantity

What to report as dangerous.

Proviso.

[1] As amended by Act 45 of the Laws of 1871, p. 45, approved and took effect March 22, 1871.

of oil used in this test shall not be less than half a pint; and it shall be the duty of said inspector to designate by his brand the temperature at which said oil will ignite.[1]

All oils to be inspected.

(1503.) SEC. 3. All illuminating oils manufactured or refined in this State shall be inspected before removed from the manufactory or refinery. And if any person or persons, whether manufacturer, vender, or dealer, shall sell or attempt to sell to any person in this State, any illuminating oils, whether manufactured in this State or not, before having the same inspected as provided in this act, he shall be subject to a penalty in any sum not exceeding five hundred dollars; and if any manufacturer, vender, or dealer of either or any of said illuminating oils shall falsely brand the package, cask, or barrel containing the same, as provided in the first section of this act, or shall use packages, casks, or barrels having the inspector's brand thereon, without having the oil inspected, he shall be subject to a penalty in any sum not exceeding five hundred nor less than one hundred dollars, or be imprisoned in the county jail not exceeding six months, or both, at the discretion of the court.

Penalty for making or selling, etc., before inspection.

Penalty for falsely branding, etc.

Inspectors may appoint deputies.

(1504.) SEC. 4. The several inspectors provided for [in] this act are hereby empowered, if necessary to the convenient and prompt dispatch of their respective duties, to appoint a suitable number of deputies, for whose official acts they shall be accountable, which deputies are hereby empowered to perform the duties of inspection, and shall be liable to the same penalties as the inspector.

Oaths of office.

(1505.) SEC. 5. Every person appointed inspector or deputy inspector shall, before he enters upon the discharge of the duties of his office, take an oath or affirmation to support the Constitution of the United States and the State of Michigan, and to discharge the duties of inspector with fidelity. He shall also execute a bond to the State of Michigan, in such sum and with such surety as shall be approved by the judge of the circuit court where appointed, conditioned for the faithful performance of the duties imposed on him by this act, which bond shall be for the use of all persons aggrieved by the acts or neglect of said inspector; and the same shall be filed with the clerk of the county where the inspectors reside.

Bond of inspector.

Where filed.

Term of office.

Duties.

Compensation.

(1506.) SEC. 6. The term of office of an inspector shall be for three years, and every inspector or deputy inspector shall, upon the requisition of any manufacturer, dealer, or vender of the oils herein mentioned, proceed, without unnecessary delay, to the inspection thereof; and said inspector or deputy inspector shall be entitled to demand and receive from the owner or party calling on him, the sum of ten cents for each and every package, barrel, or cask inspected and branded by him; and it shall by [be] the duty of every inspector or deputy inspector to keep a true and accurate record of all oils so inspected and branded by him, which record shall state the date of inspection, the number of gallons or barrels, and the name of the person for whom inspected, and the record shall be open to the inspection of any and all persons interested. And it shall be the

To keep record of oils inspected.

[1] Amended by Act 103 of the Laws of 1873, p. 136.

Deputy to make return to principal.

duty of every deputy inspector, within one week after the inspection by him of any oils hereinbefore mentioned, to make a true and accurate return thereof to his principal.[1]

Inspector not to traffic.

(1507.) SEC. 7. No inspector or deputy inspector shall, while in office, traffic, directly or indirectly, in any article which he is

Penalty.

appointed to inspect. For the violation of this section he shall be liable to a penalty not exceeding ten hundred dollars.

Oils inspected in other States to be free from inspection.

(1508.) SEC. 8. It shall not be necessary for any person to have inspected, under the provisions of this act, oils brought into this State from any other of the United States which have been inspected under the laws of any other such State, if the package, cask, or barrel in which the same is brought into this State shall bear a brand or device of the State inspector or deputy State inspector of such other State, showing that the contents thereof have been approved and stand a fire-test of one hundred and ten degrees of

Penalty for placing marks on barrel or cask to deceive.

Farenheit's thermometer. And if any person within this State shall bond,* mark, or place upon any package, cask, or barrel, any device with intent to show that the contents thereof have been inspected in any other State, or if any vender, dealer, or manufacturer of any or either of said illuminating oils shall use packages, casks, or barrels having the brand of the inspector of another State thereon, without having the oil inspected or without the same having been inspected as in this section specified, the person so offending shall be subject to a penalty in any sum not exceeding five hundred dollars nor less than one hundred dollars, or be imprisoned in the county jail not exceeding six months, or both, at the discretion of the court.[2]

Compiler's section (7731), Compiled Laws of 1871, as amended by Act No. 160, Laws of 1873, reads as follows:

Adulterated oil; making, sale, and use of, prohibited.

(7731.) SEC. 1. No person shall fraudulently adulterate, for the purpose of sale or for use, any coal or kerosene oils to be used for lights, in such a manner as to render them dangerous to use, nor shall any person knowingly sell or offer to sell, or knowingly use such adulterated oil, nor shall any person knowingly sell or offer for sale or knowingly use any coal or kerosene oil, or any of the products thereof, which, by reason of being adulterated, or for any other reason, will, at the temperature of one hundred and fifty degrees of Farenheit's thermometer, emit an explosive gas or take fire on applying thereto or plunging therein a well-lighted match:

Proviso.

Provided, That the quantity used in the test shall not be less than

Further proviso.

one-half pint: *And further provided,* That the gas or vapor from said oils may be used for illuminating purposes when the oils from which said gas or vapor is generated are contained in reservoirs under ground outside of the building illuminated or lighted by said

Penalty.

gas. Any person violating the provisions of this act, shall be deemed guilty of a misdemeanor, and shall, upon conviction thereof, be punished by imprisonment in the county jail not more than one year, or by fine not exceeding four hundred dollars, or by both fine and imprisonment, in the discretion of the court.

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[1] Amended by Act 103 of the Laws of 1873, p. 136.
[2] As added by Act 45 of the Laws of 1871, p. 45, approved and took effect March 22, 1871.
* This word is bond in the law, but undoubtedly should have been brand.

So far as I have been able to learn, these are all the laws now in force in this State on the subject of illuminating oils. The provisions of the law are so explicit that little need be said by way of explanation.

CAN OILS INSPECTED IN OHIO BE LAWFULLY SOLD IN THIS STATE WITHOUT RE-INSPECTION?

Section 1508, Chapter 33, of Compiled Laws being still in force, some parties have claimed that oils bearing the inspection mark of any Ohio inspector showing that they have been inspected, and will stand a fire test of 110° Farenheit, may be introduced into this State and sold without violating our laws.

It will be observed that this section requires that the barrels "shall bear a brand or device of the *State Inspector* or *Deputy State Inspector* of such other State," and the law proceeds to say: "If any vender, dealer, or manufacturer of any or either of said illuminating oils shall use packages, casks, or barrels having the brand of the inspector of another State thereon, without having the oil inspected, or *without the same having been inspected as in this section specified*, the person so offending shall be subject to a penalty in any sum not exceeding five hundred dollars nor less than one hundred dollars, or be imprisoned in the county jail not exceeding six months, or both, at the discretion of the court."

The oils introduced from another State, to be legally sold without re-inspection, must bear the brand of a State Inspector or of his deputy. To determine the question whether such inspection as this law requires can now be made in Ohio, the Secretary of the State Board of Health wrote to the Secretary of State of Ohio, inquiring if there is such an officer as a State Inspector in Ohio, and received the following reply:

STATE OF OHIO,
DEPARTMENT OF STATE, COLUMBUS, Dec. 10, 1873.

Hon. Henry B. Baker, Secretary of State Board of Health:

SIR—In reply to your letter of 8th inst., I beg to say that the law regulating the sale of illuminating oils in this State does not provide for a State Inspector of oils, nor has this department any knowledge of the existence of such an officer, nor does it appear from the executive records that the State has any authorized inspector.

Very respectfully,
A. T. WIKOFF,
Secretary of State.

There being no State Inspector in Ohio, the inspection which this section contemplates cannot be performed in that State, and all oils introduced into this State from manufactories in Ohio must be re-inspected to meet the requirements of our law.

OHIO INSPECTION—IS IT SUFFICIENT?

Some persons may claim that it was the evident intent of our law-makers to accept of Ohio inspection, and that to raise the objection that there is not now and never has been a State Inspector, and that hence the inspection is invalid,

is to resort to a legal quibble. I propose to show that the law now in force in Ohio in regard to the inspection of illuminating oils is not of such a nature as to inspire confidence in the inspection performed under it, because the *manufacturer himself* is made by this law the *inspector of his own oils*, and because *all penalties* for *false inspection and false branding* have *been removed.*

As a curious chapter in the history of legislation I present the following *resume* of past and present legislation in the State of Ohio on the subject of the inspection of illuminating oils.

OHIO INSPECTION UNDER FORMER LAWS.

The Ohio law, passed April 16, 1867, provided that "the judge of the court of common pleas shall appoint a sufficient number of suitable and qualified persons who are not interested in the making or vending of any of said oils" as inspectors. Sec. 2 provides that the inspector shall "reject as dangerous all of said mineral oils, known by whatsoever name, which, at the temperature of 110° Fah., will emit an explosive gas." Sec. 3 provides that "if any manufacturer, refiner, vender, producer, or inspector of said mineral oils, used for illuminating purposes, shall falsely brand the package, cask, or barrel containing the same, as provided in the first section of this act, he or they so offending, upon conviction thereof shall be fined in any sum not exceeding $500, nor less than $100, or be imprisoned in the county jail not exceeding six months, or both, at the discretion of the court;" and the act proceeds to make the parties so offending liable for any damage; and for any loss of life the parties "shall be deemed guilty of manslaughter and punished according to the statute in such cases made and provided."

Sec. 5 provides that he shall take an oath to "perform the duties of his office with fidelity," also file a bond with surety, "which bond shall be for the use of all persons aggrieved by the acts or neglect of such inspector."

Sec. 6 provides for the fee of inspector, six cents for each barrel, etc., where three or more refineries are in a county, and ten cents where there is a less number. Sec. 7 provides that "no inspector shall, while in office, buy, sell, barter, or otherwise trade, directly or indirectly, in any of the aforesaid mineral oils which they are appointed to inspect;" the penalty, a fine of not more than $500 or less than $200.

The provisions of this law were wholesome, and gave some assurance that the inspector would perform his duties. But this law is entirely a thing of the past.

It was while this law of 1867, with its stringent safeguards and severe penalties in regard to the inspector and manufacturer, was in force in Ohio that our own law of 1869, with its celebrated 8th section, was enacted. There seemed to be reason to trust to the action of a law so well guarded by penalties of heavy fines, imprisonment in the jail, or even in the State Prison. But for some reason the law was not satisfactory to somebody, for in 1872 the law was repealed, and another law enacted. Who the parties were who secured the

repeal of the law of 1867 and secured the law of 1872 in its place may easily be surmised by a comparison of the two laws. By the law of 1867, the inspector was allowed a fee of at least six cents for every barrel inspected, and this, whether he approved or rejected the oil. The Standard Oil Co. claim to have a capacity of refining 7000 barrels a day. The minimum inspection fee for this quantity would be $420. Where the oil is contained in tanks holding from 500 to 1000 barrels, the inspection of 7000 barrels a day could easily be made by one man, and the fee of $420 a day would be a princely income. By repealing the law which provided for legal inspectors and for an inspection fee for each barrel of oil inspected the manufacturers were relieved of a heavy tax. But when the office of inspector was abolished the penalties for fraudulent inspection and branding were also abolished.

THE LAW NOW IN FORCE IN OHIO.

The law passed April 27th, 1872, repealed the law of 1867 from and after the 1st of August, 1872. This law, as amended in section one in 1873, to correct the phraseology, is now the only law in force in Ohio on the subject of the inspection and sale of illuminating oils.

Section 1 provides that it shall be unlawful for any person or persons to offer for sale any illuminating oils until after *he* or *they* have tested the same as follows: by taking not less than half a pint of the oil, placing it in a dish of certain dimensions, placing in the oil a Fahrenheit's thermometer, and heating the oil "to a temperature at which said oil, fluid, or substance will emit a gas or vapor that will ignite by bringing the flame of a lighted match or other burning taper in contact with the surface of the articles being tested, * * * and if it emit a gas or vapor that will ignite at any temperature below 110 degree, Fah., then it is hereby declared to be dangerous, and it shall be unlawful to sell or offer the same for sale."

Sec. 2 provides that if any person or persons shall offer for sale any oil, etc., "until after *he or they have tested* or *caused the same to be tested*, as prescribed in this act," or shall offer for sale any oil "that will emit a gas or vapor that will ignite at any temperature below 110 degrees, Fah., he or they shall be guilty of a misdemeanor, and, on conviction thereof, shall be fined in any sum not less than $100, or imprisoned in the jail of the county not exceeding twenty days, or both, at the discretion of the court, and shall pay the costs of prosecution."

The next section is so important that I give it entire.

"Sec. 3. That if any manufacturer, refiner, or wholesale dealer of any oil, fluid, or substance mentioned in the first section of this act, as agent or otherwise, shall sell, for illuminating purposes, any oil, fluid, or substance mentioned in said section, that will emit a gas or vapor that will ignite at any temperature below 110 degrees, Fahrenheit, under the test in this act prescribed, he or they shall be guilty of a misdemeanor, and, on conviction thereof, shall be fined

in any sum not exceeding one thousand dollars, or imprisonment in the jail of the county not exceeding twenty days, or both, at the discretion of the court trying the case, and shall pay the costs of prosecution."

Sec. 4 prescribes a penalty for retailing the same, viz.: a fine of not less than $25 nor more than $200, or imprisonment in the jail not exceeding ten days, or both, and shall pay the costs of prosecution.

"Sec. 5. That if any person shall sustain any damage to his property or injury to his person by reason of a violation of any of the provisions of this act by another person, the person guilty of said violation shall be liable to the person injured for all damage sustained thereby."

Sec. 6 declares all contracts made in violation of the provisions of this act void.

Sec. 7 makes an exception in favor of cities and villages; that they may use oil below the legal standard for street lamps.

Sec. 8 repeals the act of April 16, 1867.

"Sec. 9. This act shall take effect and be in force from and after the first day of August next." Passed April 27, 1872.

I have made extended extracts from the law now in force in Ohio that the people of this State may understand the legal provisions for the inspection and sale of oil in that State. It will be observed that the office of inspector is abolished. Section one contemplates that the manufacturer shall *inspect his own oil* and pronounce upon its fitness for use. Section two provides that the vender shall *inspect* or *cause to be inspected* the oils he offers for sale. In the history of legislation I know of no other instance where the government claimed the right of inspecting and yet allowed the *interested parties to inspect their own work* or *have it inspected by parties of their own selection, with no penalties for fraudulent inspection and false branding.*

The usual practice in Cleveland seems to be that the manufacturer hires some one to inspect the oils for him, and this hired man brands the barrels, signing his name as an "Inspector;" but he has no official character; has taken no oath of office; is "appointed" by no one save as he is hired by his employer; has given no bond to indemnify persons who may suffer by his acts or neglect; may be pecuniarily interested in the oils he inspects; is *liable to no penalty for fraudulent inspection or branding, and the greatest danger he incurs is the loss of the favor of his employer.* From first to last he is the hirling of the manufacturer, and it may safely be presumed that he would consult the manufacturer's interest first and last. If he place any false and fraudulent brand upon the barrels *there is absolutely no law to punish him.* The highest test required by Ohio law is 110° Fah. If oils are branded and sold as 150° or 175° which will only bear the inspection of 110°, there is no law to punish either the inspector or the manufacturer. In this state of affairs, the public can determine how much value should be placed upon the brand "WARRANTED TO

STAND 150° FIRE TEST." Perhaps the public may conclude that it is worth just as much as the black paint consumed in affixing the brand.

By examining the present Ohio law, it will be seen that every safeguard in regard to inspection has been thrown down. The manufacturer and vender alone are held responsible, and they are amenable *only when they sell oils below the inspection of 110° Fah.* The law would seem inadequate to restrain the manufacture and sale of oils below this low standard, when we remember that some of these companies represent a capital of millions of dollars, and that the profits of a single days adulteration would pay the expenses of a year of litigation. The laws of that State are so framed that we cannot trust inspection thereunder. The wealth of those corporations would exclude all hope of successful litigation. The only safe way is by rigid inspection in this State to exclude their dangerous oils from our market. We can thus "flank their position," and compel them to either sell us safe oil or abandon our market. This is the very end our laws aim to secure, and which will be speedily secured if they are enforced.

METHOD OF INSPECTING OIL IN OHIO.

Defective as is the Ohio law, I consider the method of inspection more faulty still. I am informed by an agent of one of these oil companies, and by one of these so-called "inspectors," that the method laid down in the Ohio law is not followed in inspection. The Ohio law requires that not less than half a pint of the oil should be used, and that the flame of the burning match should be brought in contact with the surface of the articles being tested. Instead of this method these self-styled inspectors have adopted what they call "The Commercial Method,"—a method, so far as I can learn, which has been sanctioned by no Legislature, Board of Trade, Convention, or other body. The method may have originated in Dickens' Circumlocution Office, for it is a good example of "how not to do it."

The method, as I have witnessed it, is as follows: Four or five ounces of the oil are placed in a small glass vessel, filling it to the brim. A Fahrenheit thermometer is placed in the oil, so that the bulb is covered by the oil. The oil is slowly heated by a water-bath and a minute hickory splinter, ignited, is whisked very rapidly over the surface of the oil and some distance above it, till the vapor ignites with sufficient volume of flame to ignite the oil. This is called "the fire test," and the lowest temperature at which the oil will take fire when thus treated is called its degree of fire test.

Persons who have never given any especial attention to the subject might consider this method satisfactory, but there are several grave objections to it, and the results arrived at by this method may be very far from the truth. In the first place the quantity of oil used in this method is too small, and is less than is required both by our law and that of Ohio. In the second place there is no screen used to retain the vapors formed. The vapor of benzine is more than two and a half times as heavy as air, and the vapors of heavier oils are

still heavier than those of benzine, and if these vapors form from oil which fills the cup brimful, they will naturally flow down the sides of the cup, or they will be dissipated by any movement of air over the surface of the cup. It is only when the vapors form so rapidly that they cannot readily escape that they will accumulate in large quantity over the oil, being heaped up as it were over the surface. In the third place our law requires "a well-lighted match" to test the presence of combustible vapors, and the Ohio law specifies a "lighted match or other burning taper." Ohio inspectors use a minute hickory splinter which gives a very small flame. This ignited splinter is rapidly passed over the surface of the oil and some distance above it. It is very easy to whisk such a burning splinter at such a distance above the surface of the oil as to avoid contact with the heavy vapor forming on its surface, and the operation may be so performed as not to reveal the existence of such vapor, even when it is freely escaping from the oil. The results of this method of inspection are too much within the control of the operator to give reliable results, especially if the inspector is pecuniarily interested in the results of the inspection.

METHOD OF INSPECTION RECOMMENDED BY THE STATE BOARD OF HEALTH.

It is very desirable that such a method of inspection should be used as will be beyond the personal control of the operator so far as the results are concerned; that may be easily performed, so that a person of ordinary care and skill may employ it; and that shall determine whether the oil is safe to use in ordinary lamps, even when exposed to such accidents as are of frequent occurrence. The oil in a lamp is in a confined space, without opportunity for the vapor to freely escape into the air, and one chief object in inspection should be to determine whether the oil, at such a temperature as may readily be attained in a lighted lamp, will form combustible or explosive vapors in such confined space. The State Board of Health have therefore adopted and recommended an oil-tester which will approximately fulfill these conditions.

STATE BOARD OF HEALTH OIL-TESTER.

This consists of a stand or support which is a cylinder of sheet copper $7\frac{1}{2}$ inches high and $3\frac{1}{2}$ inches in diameter, with an aperture in the side at the bottom for introducing a small spirit lamp; a water-bath consisting of a copper cup $3\frac{3}{8}$ inches high and 3 inches in diameter, which fits into the top of the stand and is supported by a flange at its top; an oil receptacle 3 inches high in the lower section and $2\frac{3}{4}$ inches in diameter; on the inside of this vessel is a socket to support the rod to hold the thermometer; at the top of this section there is a flange about one-quarter of an inch wide which serves to support the oil vessel in the water-bath, and to the edge of this flange is soldered a second section one inch high, forming a vapor chamber one inch deep above the top of the oil vessel; a cover fitting loosely on the top of the vapor chamber, in which is a small hole for the insertion of the supporting rod for the thermometer, a hole for the insertion of the thermometer, and a larger hole to insert the burning match into the vapor chamber.

The superficial area of the oil vessel complies with the requirements of the Ohio law, viz.: "Shall not exceed six nor be less than four square inches in area." The oil vessel, filled to the flange, holds ten fluid ounces, and in this respect complies with the laws of both Michigan and Ohio, viz.: "not less than half a pint." I append

DIRECTIONS FOR USING THE STATE BOARD OF HEALTH OIL-TESTER.

Remove the upper cup and pour into the second cup 2 or 3 ounces of cold water, or enough to fill the space between the first and second cup. Replace the upper cup, and place both in the top of the tall cylinder. Pour enough of the oil to be tested into the upper cup to fill it to the edge of the flange. Remove any air bubbles with a piece of dry paper. Pass the supporting rod through the smallest hole in the cover, and insert the rod in the socket on the inside of the cup. Place the bulb of the thermometer in the smaller of the two remaining holes in the cover, and attach the loop to the hook of the supporting rod; the oil should just cover the bulb of the thermometer. Fill the small lamp with alcohol, light it, and trim the wick so that it shall burn with a small flame. The lamp should not raise the temperature of the oil more than 5° or 6° a minute.

In all instances before applying a lighted match to the oil or its vapor, note the temperature by the thermometer.

To ascertain the *flashing point*: insert a well-lighted match into the largest hole in the cover, rapidly bringing the flame into the space under the cover and above the oil; continue to do this with every increase of temperature of 2° or 3° till the vapor burns with a slight puff and a bluish flame. The lowest temperature at which the vapor will thus burn is called the *flashing point.*

To ascertain the *burning point:* remove the thermometer, and swing the cover to one side, using the supporting rod as a pivot. Replace the thermometer in the oil, and plunge a well-lighted match into the oil; continue this experiment for every rise of 1° or 2° till the oil takes fire and continues to burn. The lowest temperature at which the oil will thus take fire and continue to burn is the *burning point.*

When the oil takes fire, a vigorous puff of the breath will usually extinguish the flame.

Before using the apparatus for testing any oil, the upper cup should be wiped clean from any traces of the oil of a previous trial.

This tester is so simple in its construction and use that almost any person can readily test oils by it and arrive at very accurate results. The oil-tester which I have used in the inspections which I have made for this report had no cover to the vapor chamber.

In the following table will be found the results derived from re-inspection of a large number of specimens of oil gathered from various parts of the State. In this table the term "flashes" refers to the temperature at which the oil gives off sufficient vapor to take fire when a lighted match is placed in the vapor; the term "takes fire" means the temperature at which the oil takes fire and continues to burn either when ignited by the combustion of its vapor or when a lighted match is plunged into the oil:

RESULTS OF RE-INSPECTION IN THIS STATE.

KALAMAZOO.

Manufacturer.	"Inspector."	Inspector's Mark.	Flashes.	Takes Fire.
Standard Oil Co.	E. Fowler	Warranted to stand 150° Fire Test	116°	126°
" "	"	" " "	110	126
Wm. H. Doane	"	" " "	135	147
Scofield, Squire & Teagle	"	" " "	130	135
" " "	"	Warranted to stand 175° Fire Test	160	160
Buckeye Oil Works	W. M. Greatrake	Warranted to stand 150° Fire Test	130	135
F. M. Backus	E. Fowler	" " "	135	142
Chase, Hanford & Co.	"	" " "	135	142
C. H. Cobb & Co.	"	" " "	150	157

JACKSON.

Standard Oil Co.	E. Fowler	Warranted to stand 150° Fire Test	112	132
" "	"	" " "	115	130
" "	"	" " "	122	128
" "	"	" " "	115	133
" "	"	" " "	112	125
" "	"	" " "	115	129
" "	"	" " "	118	130
" "	"	" " "	110	125
" "	"	" " "	118	135
" "	"	" " "	115	132
" "	"	" " "	114	128
" "	"	" " "	116	126
Salamander Oil Co.	"	" " "	118	130
Commercial Oil Co.	"	" " "	110	122
" "	"	" " "	110	122
" "	"	" " "	110	122
" "	"	" " "	110	122

MUSKEGON.

——— ———	———	——— ——— ———	110	121
——— ———	———	——— ——— ———	112	120

GRAND RAPIDS.

Standard Oil Co.	E. Fowler	Warranted to stand 150° Fire Test	120	133

DOWAGIAC.

Standard Oil Co.	E. Fowler	Warranted 150° Fire Test	110	122
" "	"	" " "	120	132
Chase, Hanford & Co.	"	" " "	127	145
Cleveland Oil Co.	"	" " "	115	132
Am. Lubricating Oil Co.	J. J. Adams	Warranted above 150° Fire Test	95	104
Am. Oil Co.	"	150° Fire Test	90	100

LANSING.

Standard Oil Co.	E. Fowler	150° Fire Test	110	120
" "	"	" "	112	123
" "	"	" "	100	109
" "	"	" "	110	120
" "	"	" "	110	120
" "	"	" "	115	126
" "	"	" "	110	120
" "	"	" "	110	120
" "	"	" "	110	120
" "	"	" "	115	125
" "	"	" "	105	115
" "	"	" "	105	115
" "	"	" "	105	115
" "	"	175° Fire Test	152	158
Commercial Oil Co.	"	150° Fire Test	100	109
" "	"	" "	102	112
Morehouse	"	175° Fire Test	142	155

BRONSON.

Manufacturer.	"Inspector."	Inspector's Mark.	Flashes.	Takes Fire.
——— ———	E. Fowler	Warranted 150° Fire Test	110	122
——— ———	"	" " "	127	136

DETROIT.

W. H. Doane	E. Fowler	Warranted 150° Fire Test	133	141
Corrigan & Co.	"	" " "	120	130
Standard Oil Co.	"	" " "	123	130
" "	"	" " "	123	130
" "	"	" " "	125	135

The following were purchased at small shops in Detroit, and I could not learn the name of the manufacturer or "inspector." They were all said to be 150° oil:

——— ——— — —		150°	110°	120°
——— ——— — —		"	120	130
——— ——— — —		"	102	112
——— ——— — —		"	125	136
——— ——— — —		"	110	120

I have examined other samples of oil, but the above will serve as specimens.

I am indebted to Dr. S. S. Garrigues, inspector for Saginaw county, for the following report of re-inspection of oils in East Saginaw. I present his report to show that it is not because of my method of inspection that oils fail to stand their inspection brand:

Manufacturer.	"Inspector."	Inspector's Mark.	Flashes.	Takes Fire.
Commercial Oil Co.	E. Fowler	Warranted to stand 150° Fire Test	120°	——
Standard Oil Co.	"	" " "	125	——
" "	"	" " "	125	——
" "	"	" " "	125	130°
" "	"	Warranted to stand 110° Fire Test	100	——
" "	"	Warranted to stand 150° Fire Test	125	130
" "	"	" " "	125	130
" "	"	" " "	125	130
" "	"	" " "	125	130
" "	"	Warranted to stand 175° Fire Test	150	154
Doane & Chase	"	" " "	——	154
W. H. Doane	"	" " "	165	170
Standard Oil Co.	"	" " "	155	162
" "	"	" " "	145	152
Mix & Cooke	"	" " "	150	155

NAPHTHA AND BENZINE AS ILLUMINATORS.

I now come to the consideration of a far more dangerous class of substances which have been, and to a small extent are still in use in this State. Naphtha and Benzine are sold under a great number of deceptive names which conceal from the consumer their real nature, and thus he is led, in entire ignorance of their properties, to use the most dangerous substances, even in the presence of wife and children. It is sold in other States under many fanciful names, *e. g.*: "Liquid Gas," "Aurora Oil," "Safety Gas," "Petrolene," "Puroline," "Black Diamond," "Septoline," "Anchor Oil," "Sunlight Non-explosive Burning Fluid," etc., etc.

I have obtained specimens from various parts of the State, and I will give the

trade name by which it is known in various places. I have a specimen from Wenona, and another from East Saginaw where it is called "Burning Fluid;" from Jackson "Petroleum Fluid;" from Dowagiac "R. F. Danforth's Fluid;" from Detroit "Carbolite" and "Gasoline;" from Hudson "Carbon Fluid;" in Howell it was sold as "Rose Oil," but I was not able to obtain a specimen, as the following letter will explain:

HOWELL, January 10, 1874.

DR. R. C. KEDZIE:

Dear Sir,—I received from Mr. G—— the money which you sent, with the request to get for you a sample of the Rose Oil, or Gasoline.

I would have been very glad, indeed, to have served you, and tried to get the sample; but through a little incident it was rendered impossible. While you were talking with Mr. G——, there sat near you a gentleman from this place, an intimate friend of the Rose Oil dealers, who overheard a part of your conversation,—just enough so that he saw something was on foot; so he came home and told the parties he had seen a State Agent who was *after them.* They were thoroughly scared, and thought the whole detective force of the State was concentrated on them, and immediately bunged up their barrels and shipped them off, so that when I came into market there was not a drop to be had.

I am yours truly,

H. T. B.

The most dangerous form in which these materials are presented to the public is the secret recipes and patented methods sold by parties through their agents all over the country. These patented methods pretend to remove the dangerous and explosive qualities from the naptha or benzine, making it entirely non-explosive and perfectly safe to use. Prof. Chandler, of New York, has published some of these patents, and I present a few samples to show how ridiculous and absurd are the means by which it is claimed that the explosive quality is removed.

They are taken from Patent Office Report for 1866:

No. 57,390. White oak bark, 2 pounds; alkanet root, 2 pounds; salt, 2 pounds; alcohol, 1 pint; cyanide of potassium, 1 ounce. To be added to 3 gallons of naphtha to make it non-explosive.

No. 58,749. Naphtha, 40 gallons; carbonate of soda, 3 pounds; alum, 2 pounds; hydrate of lime, 2 pounds; slippery elm, 2 pounds; gum camphor, ½ pound; oil of sassafras, 4 ounces; essence of tar, 1 ounce.

No. 58,180. Naphtha, 40 gallons; potatoes, 50 pounds; lime, 4 pounds; sal soda, 4 pounds; curcuma, 3 pounds.

No. 59,797. Gasolene, 40 gallons; sulphur, 5 pounds; rusty iron, 100 pounds; onions, 1 bushel; rosin, 5 pounds.

These materials can have no possible influence to check the combustibility of the naphtha, or to prevent the tendency to form explosive vapors under favorable circumstances, and the oil is left in the same dangerous condition as before their addition. They are mere gull-catchers. In the same category belongs the powders hawked about the State, to add to dangerous kerosene to keep it from exploding. The properties claimed for some of these powders are

wonderful, if true. Thus it is said that they will toughen the glass so that the lamp cannot break, and the chimney will never crack if this powder is used. I have a sample before me, which is labelled,—

"Fire Test Powders. Directions:—To one gallon of oil put one teaspoonful of the preparation, and shake well. A. W. WYBLE, Charlotte, Mich."

The box contained 2½ ounces of *common salt*, colored with Aniline red. This stuff is sold for 75 cents a box.

Another specimen has the following label and directions:

"Agazziz gas-killer—warranted genuine. DIRECTIONS:—To one quart of oil put one teaspoonful of the preparation, and shake well. W. H. RYAN & Co., Albion, Mich."

Shade of Agassiz! hast thou come to such base uses at last?

The following handbill accompanies the box. I reproduce it *verbatim* as a literary curiosity:

"No more explosions from kerosene oil, and saves you one gallon in five, and making it as safe as water, and prevents the braking of chimneys, and removes the unpleasant odor from the oil. You that burn the oil should look to the safety of your family and your homes, as the cost is but a trifle and makes you safe. 60 cents per box or two for one dollar. For sale by W. H. RYAN & Co., Albion, Michigan."

A box of this "Gas-Killer" contains nearly an ounce of common salt, colored with Aniline red—and that is all there is of it.

To sell common salt stained with a little coloring matter for $4 to $8 per pound, indicates business enterprise!

But the enterprise of our people is not alone displayed in such restricted fields. A party signing himself M. Wagner & Co., carried on a large business in Marshall, in this State, in the sale of a "Recipe for Sunlight Oil." It is sold to single families at two dollars each. I am told by a respectable citizen of Marshall, that this M. Wagner amassed a large fortune in this trade. I am informed that he has transferred his headquarters to Chicago, where he is probably still engaged in this business. I extract from Prof. Chandler's Report the—

RECIPE AND DIRECTIONS FOR MANUFACTURING THE SUNLIGHT OIL.

"To make one gallon, take 3 quarts of Benzine, 1 oz. of pulverized Alum, 1½ ozs. Alcohol, 2 ozs. Cream Tartar, 2 ozs. Sal Soda, 1 pint of potatoes (cut fine), 2 table-spoonsful of fine Salt, 2 drachms Oil of Sassafras, 4 drachms Gum Camphor. Dissolve the Alum in the Alcohol as much as possible, then add the Gum Camphor, stir for a few minutes, then add to one pint of the Benzine; stir it well for ten minutes, then add all the other ingredients except the Benzine; then add the remainder of the Benzine; leave it open and exposed to the air for about fifteen minutes, then cork or cover it tight, and in two hours' time it will be fit for use, although it should stand, if convenient, for forty-eight hours before using. This is the proportion for one gallon, and the person who purchases the ingredients of a retail druggist for a single gallon will be charged two or three times the wholesale price for a single gallon of Benzine, as many retail druggists often buy but a few gallons at a time and

have to pay about twice the wholesale price. You are to use Benzine of 65 or 72 gravity, which costs but 12½ cents per gallon in New York, Chicago or Cleveland, and but 8 cents in Pittsburg.

"The ingredients used in one gallon will answer for ten gallons by adding 8½ gallons of Benzine, one quart Potatoes and one pint fine salt. The Sun-Light Oil should always be used with a patent or Sun-Light Burner. ☞Any individual detected making or selling the Sun-Light Oil without a right from us will be prosecuted as an infringer.

"(Not transferable.) Beware of Counterfeits.—No Right genuine unless it has upon the upper left hand corner the likeness of Madame Culver, wife of the late Dr. S. A. Culver, the inventor of this Oil."

The following circular is used to secure agents and purchasers for this villainous fluid:

"THE SUN-LIGHT OIL."

"THE BEST BURNING OIL IN THE WORLD."

"Dr. Culver's Celebrated Sun-Light Oil is one of the Greatest Discoveries of the Age. M. Wagner & Co. are Sole Proprietors for the United States and Canadas. Sold only by their Authorized Agents."

"COSTS BUT TWENTY-EIGHT CENTS PER GALLON TO MANUFACTURE,

"And can be manufactured anywhere in the United States and Canada.

"This wonderful oil, which is about to take the place of kerosene and other burning fluids, is composed of materials which can be obtained in any country village. Can be made without the aid of machinery, by simply mixing the ingredients together. It has no offensive smell whatever, and is

"WARRANTED TO BE NON-EXPLOSIVE."

"It burns without any smoke, and gives a softer and far more brilliant light than any other oil now in use, and is only equaled in brilliancy by gas-light. The ingredients which compose it are simple and cheap, costing but twenty-eight cents per gallon at the highest, and can be procured in any city or country village in the United States. A gallon of the oil can be made in five minutes, and a whole barrel in less than half an hour. Wherever it has been introduced it takes the place of kerosene and other burning fluids, for the following reasons:

"1. Because it does not cost half as much; 2. It can be made anywhere by anybody; 3. *It will never explode;* 4. *It will burn in any lamp, with or without a chimney;* 5. It will not smoke the chimney; 6. It will give no bad odor or offensive smell; 7. It will not soil clothes, if spilled upon them; 8. It gives a clear and steady light, never flickers, and in softness and brilliancy is only equaled by gas; 9. It will burn one-fourth longer than the best kerosene made; 10. It does not weaken the eyes or lungs, as kerosene or coal oil does, by continued use. And, finally, it is cheaper and better in every respect than any other oil ever invented.

"For lighting stores, hotels, and public places of all kinds, there is no oil that will at all compare with this in cheapness, brilliancy, and safety. For night lamps in hotels, public and private houses, it is invaluable, and can be used in small lamps as well as large ones, without chimney, giving out no smoke or smell, and does not encrust the wick.

"Although this oil has been before the public but a few months, *nearly* 350,000 *families are making and using it.* And wherever it has been introduced, kerosene and other burning fluids have been laid aside. This celebrated oil was discovered and first invented in June, 1867, by the great French chemist and geologist, the late Dr. S. A. Culver, of Paris. *Fortunately for us, being near relatives of his, we succeeded, before his death, in obtaining the sole right to manufacture and sell the oil in all parts of the United States and Canadas.*

"In order to bring this oil into universal use throughout the country, we have concluded to sell it only through agents. By this method families can manufacture the oil themselves, thus getting it at original cost and saving all the profits that would be made by merchants and speculators, if sold through them. The oil can be manufactured any where for twenty-eight cents per gallon, and in many places for much less. And while the cost is small, you have a light with which you can always feel safe, for it can in no way be made to explode; and the softness and brilliancy of the light will render cheerful the kitchen, the parlor, and the place of busines. It gives a clear and steady light; and one gallon, with the same lamp and the same sized blaze, will burn six and one-quarter hours longer than the best kerosene. It is certainly

"ONE OF THE GREATEST WONDERS OF THE AGE.

"All we ask is, that the public give this oil a general investigation; that they test its merits and its qualities for themselves, and then, finding (as they surely will) that it is laden with results that will be beneficial to all persons in every city, village, and farm-house in our land, we respectfully ask that they lend their influence in our behalf to aid in its advancement and circulation.

"Such a demand is there for this oil, that some of our agents, who are energetic, are now making, on an average, from $400 to $500 per month, clear of all expenses, and the demand for it is constantly increasing. We shall endeavor to establish at least one agent in every county in the United States and Canadas; and the right to manufacture can only be obtained from him or from us. Again we remark, that all we desire is that every family test the merits of this wonderful oil, which they can do when the agent calls; and after they have thoroughly tested its qualities, it would be but waste of time and breath for the agent, or for us, to ask them to purchase the right to manufacture their own oil, for there is not one family out of every thousand but that would have the right to manufacture the oil even if the price of a Family Right were five times as high as we have placed it. In order that all may be benefited by this oil, and none, however poor they may be, need be prevented from using it and enjoying its benefits, we have placed the price of Family Rights at the small sum of two dollars each.

Agents Wanted in every County not yet Taken.

"If further information is desired, address, with stamp,

M. WAGNER & CO.,
Marshall, Mich."

For some reason M. Wagner & Co. did not cultivate the home trade; their business had been carried on for months before the people of Marshall knew much about it, and even then it was very difficult for residents of Marshall to gain admittance to their office, or to buy the Sunlight Oil, or the recipe for manufacturing the same. The firm advertised in papers distant from this State, and most of their business was done in other States. Their plan seems to have been to advertise a safe and lucrative business, guaranteeing a large salary. When parties wrote to inquire what the business was, the reply would be that they had a method of manufacturing Sunlight Oil,—that they would give him the exclusive agency for a certain district where he would sell family recipes for two dollars, retaining his salary out of the proceeds of sale, and remit the balance to M. Wagner & Co. The cost of outfit would be $10; which outfit and agency would be forwarded by express on receipt of $10. If the man sent the money a small package containing blank recipes, a specimen of Sunlight Oil, and perhaps a lamp would be forwarded. The orders came in with astonishing rapidity, and the firm speedily acquired a fortune.

When M. Wagner & Co. transferred their business to Chicago and turned their backs upon us, it seemed as though the people of our State were to be left in the dark; but their mantle fell upon the shoulders of A. Coulter & Co., of Charlotte, Mich., who sell the right to manufacture and use the "FRENCH BURNING OIL." They seem to have followed the tactics of M. Wagner & Co., advertising their business in papers far off, and keeping the matter very still at home. It was very difficult to gain admittance to their office. I tried the experiment without success. After a few months, however, their business became known, when A. Coulter & Co. also transferred their business to Chicago.

I present a full copy of their FAMILY RIGHT FOR THE FRENCH BURNING OIL:

In consideration of two dollars, received from Mr. ————, of the town of ———, county of ———, State of ———, who, having this —— day of ——, 1873, paid the sum to A. Coulter & Co., or their authorized agent, we do hereby convey to him the right to manufacture the FRENCH BURNING OIL, and to use the same in his own family, to wit: The right to use it in his private dwelling house, his shop, store, office, or other place or places of business, but is excluded from using it in any other person or persons' private dwelling house, shop, store, office, or any place or places whatsoever not his own. The purchaser agreeing not to sell the oil, or cause the same to be sold, or communicate to others the recipe, or art of making the French Burning Oil. And the said purchaser is to have the right to manufacture and use the aforesaid during his lifetime. It will then pass to his heirs or legal representatives.

IN WITNESS WHEREOF we have hereunto affixed our names the day and year above written.

A. COULTER & Co., [L. S.]
Sole proprietors for the United States.

PROCESS OF MAKING THE FRENCH BURNING OIL.—NOT TRANSFERABLE.

40 Gallons Benzine, 3 lbs. Whiting, 3 oz. sweet spirits nitre, 3 oz. spirits Ammonia, ½ oz. Camphor Gum, 4 oz. fine salt. Draw from the barrel six gallons, pour in a tub; first add Whiting and salt, dissolve the Camphor in a bottle, well shaken, add to the six gallons in the tub, stir the whole for five minutes, after settled dip off carefully into the barrel.

The above is known as the French Burning Oil, and excels all others as a safe, cheap, and lasting oil; it cannot be equaled. If you only buy a single gallon of Benzine at one time, in very many small towns, you will be charged two or three times the usual retail price. Should this be the case with you, send to New York and order a barrel, by so doing you get it at 15 cents per gallon. By doing this you will get the genuine.

To make one gallon:—Add to one gallon Benzine two tablespoonfuls of Whiting, one teaspoonful of sweet spirits nitre, one teaspoonful spirits Ammonia, one teaspoonful fine salt, and a teaspoon one-third full of Camphor Gum. Put the above ingredients into your coal oil can, with the Benzine, and let it stand 24 hours before using, keeping the can shut. When you have used a gallon, before making another, wash out your can with hot soapsuds. *Be very particular to clean and fill your lamps in the day-time.* Remember this.

If trouble is experienced in making this oil burn nicely with the common kerosene burner, as sometimes happens through the great impurity of Benzine used, application should be made to us for a Vesta burner.

————, *Agent.*

The materials directed to be used in making this French Burning Oil are without any influence in checking the inflammable properties of benzine. The "whiting" or impure carbonate of lime, and the "fine salt" are without influence because they are entirely insoluble in benzine. The "camphor" and "spirits of ammonia," if they have any influence, would increase the dangerous combustibility of the benzine: the "sweet spirits of nitre" acts as a diuretic on the animal system,—perhaps A. Coulter & Co. would claim that it would have the same influence on this French Burning Oil!

It would seem from the directions that this dangerous material is to be used "with the common kerosene burner," but if it does not "burn nicely" they will furnish a "Vesta Burner."

Now how safe is a person holding in his hand a lighted lamp containing this "French Burning Oil," "Sunlight Oil" or any compound of naphtha or benzine? The material rapidly burns away, and the lamp becomes filled with an exceedingly combustible vapor: when this vapor is mixed with a certain proportion of air, it is as explosive as gunpowder. If, by any opening in the lamp, flame can reach this vapor, it will explode, bursting the lamp and scattering the burning material in all directions, enveloping the person in a winding sheet of flame, bringing death in its most horrible form. Or suppose the person by a fall or any other means breaks his lamp without extinguishing the flame, the whole of the benzine will burst into flame, and a death of untold agony is the result. A person carrying a lighted lamp filled with such materials, *holds his death warrant in his hand, and a stumble may furnish an*

executioner at any moment. They should be labelled HOMICIDE MADE EASY; OR, EVERY MAN HIS OWN EXECUTIONER!

The dangers from the use of these oils of low specific gravity are no fancy picture. Mrs. Beattie, a most estimable lady, wife of one of the principal citizens of Howell, on the evening of the 5th of August last, had disrobed for retiring, but before doing so she took a lamp filled with "Rose Oil" to go to the chamber for an additional bed-quilt: She tripped and fell, and the lamp broke, throwing the burning fluid all over her person. Her husband hearing her agonized screams rushed to the foot of the stairs where his wife met him entirely enveloped in flame. In endeavoring to tear the burning clothes from his wife, Mr. Beattie was so severely burned that he came near losing his life. His wife lingered in terrible agony for six hours and died.

A person would suppose that so awful an accident would put a stop to the use and sale of so dangerous an article in Howell, but the sale was not arrested, and five months after, I learned that the Rose Oil was still for sale, and only when I tried to get a sample did the parties become "thoroughly scared, and thought the whole detective force of the State was concentrated on them, and immediately bunged up their barrels and shipped them off."

Mr. H. L. Hines of Delta, Eaton Co., carried home a can of "Non-Explosive" oil, which he told his family "would not explode even if it was thrown into the fire." He proceeded to demonstrate its non-explosive qualities, notwithstanding the remonstrances of his family and friends. A terrible explosion was the consequence, the burning oil was thrown upon the clothes of his wife who was immediately enveloped in flames. Terror-stricken she rushed out of doors and ran to the house of a neighbor. She was so terribly burned that she lived but four hours. The little child, three years old, was frightfully burned and soon died. Mr. Hines was badly burned on the face and arms. A lady present at the time was severely burned. The burning fluid set fire to the house, which, together with the furniture, was reduced to ashes.

Agents, in selling the right to make and use these murderous compounds, are very ready to demonstrate that "they are entirely non-explosive," and for this purpose they pour a small quantity into a saucer and apply a match, when "it does not explode,—it only burns, as you see." I have tried the very same experiment with *nitro-glycerine*,—pouring a quantity into a capsule and repeatedly plunging a lighted splinter into the nitro-glycerine, when it did not explode,—did not even take fire, except so much as adhered to the burning stick. Judged by this test, *nitro-glycerine is entirely non-explosive!* Yet I would not advise any one to burn it in a lamp!

Or the agent will unscrew the lamp top and plunge a burning match into the lamp, when the oil takes fire and burns without any explosion. There is no explosion because there is usually too much vapor to explode. The vapor itself is not explosive, and it only becomes so when mixed with a certain amount of air. Prof. Chandler says: "Equal volumes of vapor and air will

not explode; three parts of air to one of vapor give a vigorous puff when ignited in a vessel. Five volumes of air to one of vapor give a loud report. The maximum degree of violence results from the explosion of eight or nine parts of air mixed with one of vapor."

When any of these vapors are mixed in proper proportion with air, the mixture becomes powerfully explosive, as was shown by the explosion at Bennington, Vt., a report of which I insert, taken from the Detroit Post:

BENNINGTON, Vt., January 21, 1874.

The terrible explosion of yesterday still engrosses the attention of all, and hundreds of persons have visited the town to-day out of sheer curiosity, to witness the scene of the catastrophe.

The Green Mountain Knitting Mills, which proved the sepulcher of nine human beings, are of brick, one story in height. The main part of the mill was 60x60 feet. On the west side was a wing 125 feet deep. On the east side was one 100 feet deep, both of brick, and 50 feet wide. There was a large L in the rear in which was the boiler used to heat the building and to supply steam for an engine when sufficient power could not be obtained from the water-wheel. The company has used a

PORTABLE GAS APPARATUS,

known as the Springfield machine, in which gasoline was used to make gas by evaporation for lighting the mill. The pipes holding the gasoline were leaking in the boiler-room, and a man was engaged in repairing them. During this operation the escaping gasoline vaporized and pervaded the room, as well as the apartments adjoining. As soon as the gas came near the boilers a terrible explosion was heard, and in an instant the whole building was filled with flames.

THE EXPLOSION

lifted the roof from the side walls, which fell out, and it dropped down upon the heads of the employes in that part of the building, crushing them, and imprisoning them beneath the ruins. The mass of timber and brick falling without warning upon the women employed caused instant death to a number. The explosion was heard a distance of 18 miles, and was plainly discernable at Arlington, some 16 miles away. Coincident with the explosion the entire building was

FILLED WITH FLAMES,

the all-pervading gasoline vapor igniting like powder, and spreading through the whole. Most of the doors were blown from the hinges, and in a moment the whole building was wrapped in flame. The firemen were powerless to help the women imprisoned there, who were rapidly burned to death.

THE SCREAMS WERE HORRIBLE

to hear, and their agonized cries for help were enough to put energy and courage into the nerves of every man, but all efforts were fruitless, and the unfortunate women perished miserably. After considerable time had been spent in subduing the flames, a search was made among the ruins, and the

CHARRED REMAINS OF NINE BODIES

were recovered. In every instance there was no possibility of recognition directly, and the only guide to the names of the killed was the fact that the

remains found were supposed to be those of the persons who worked at the benches where these remains were found.

This and similar accidents show that these volatile fluids are even more dangerous than gunpowder, which is a passive agent, and only explodes when fire is brought to it, while benzine is an active agent, sending out its volatile arms to draw the fire from a distance.

The *sale* and *use* of these dangerous oils is clearly forbidden by law, under penalties of heavy fine or imprisonment. The recklessness with which they have been used in this State is appalling. Thus I have been informed that a second-class hotel in Detroit is lighted with "Carbolite," and a church in the same city (I do not suppose any Episcopal church would like to be called second-class), was lighted with the same material up to a recent date. I am informed that dealers in Saginaw advertise "Burning Fluid for mechanical purposes only." It is time that our laws should be enforced, and that these parties who throw dice with death for a few pennies' profit should be made to feel that human life is too precious to be thus sold for gain. Almost every newspaper brings us some new horror, where whole families are roasted like martyrs at the stake. "No wonder we have kerosene accidents, with agents scattered through the country selling county rights and family rights, and teaching the people how to make these murderous 'non-explosive' oils."

WHAT IS A SAFE OIL?

Naphtha, benzine and gasoline, under whatever names known, are not safe to use in any lamp:

First.—Because they all give off a combustible vapor (explosive when mixed with enough air), at all temperatures found in any inhabited dwelling. I have tested a number of them, and find that even when cooled down to eight degrees below zero, they will flash and take fire when a lighted match is brought near the surface. The whole body of the oil bursts into flame, and if in any large quantity, the application of water will often fail to extinguish the flame, the oil floating and burning on the surface of the water.

Second.—The low temperature at which these oils will boil is another source of danger. Gasoline will evaporate so rapidly at ordinary temperatures as to produce great cold. A barrel of gasoline was left in an alley in Lansing, and on a hot day in July a friend of mine found it covered with hoar frost. The gasoline was leaking, and the rapid evaporation produced sufficient cold to condense and freeze the atmospheric moisture. The boiling point of benzine is so low that the accumulation of the vapor within the lamp may cause it to explode like a steam boiler. A friend of mine in Saginaw was accustomed to use benzine under the name of burning fluid. One evening the lamp had been burning some time, when it suddenly began to boil up and overflow the top of the lamp, which was speedily enveloped in flame. He sprang to seize the lamp to remove it, but before he reached it, the lamp exploded, sending the fragments of glass and the literally *burning fluid* in all directions. For-

tunately the destruction of property was small, and the customary waste of life was omitted. My friend does not now use the "non-explosive burning fluid."

Third.—If the lamp is broken without extinguishing the flame the whole body of the oil is instantly covered with flame. The breaking of lamps is so common an occurrence that it is not safe to trust our lives to the accidental extinguishing of the lamp at the time it is broken.

LOW GRADE KEROSENE IS NOT SAFE.

First.—Because the oil in lamps used in our "living-rooms" often reaches a temperature at which the low grade kerosenes give off a combustible vapor. Prof. Chandler tried a number of experiments with lamps of various kinds to ascertain the temperature of the oil after burning a number of hours. In one instance he found the temperature 120°; in another 118°; in another 104°. In another set of experiments where the temperature of the room was 90° to 92° the oil in one lamp reached the temperature of 129°; in another 126°; in another 116°; in another 112°; in another 110°; in two others 102°. These temperatures were exceptionally high, but kerosene which would give off a combustible vapor at such temperatures could not be safely used in such circumstances. But it may be asked: Will not the high grade oils reach a higher temperature when burning in a lamp than a low grade oil, and hence be equally dangerous? I have made some experiments to test this matter, and found the low grade oils reached a higher temperature in lamps than high grade. The experiment was made with lamps of the same kind, trimmed in the same way, and burning side by side, but with oils of 150°, 120°, and 110° fire test. The highest temperature of the 150° oil was 93°; of 120° oil was 97°; and of 110° oil was 98°. The tendency in all lamps is to attain a higher temperature as the oil burns away, and hence the increased danger with lamps partly filled.

ADDITIONAL EXPERIMENTS.

Since the foregoing was written, I have received the following results of interesting and instructive experiments made by H. G. Coleman, of Kalamazoo. I give the results very nearly in Mr. Coleman's own words:

EXPERIMENT No. 1.
Fire test of oil, 111°.
Temperature of room, 68°.
Temperature of oil taken, 68°.

Argand Burner. I kept it burning in a room of this temperature for four hours, when the temperature of the oil rose to 89°. I then removed the lamp to a room where the temperature ranged from 110° to 115°, for two hours, when the temperature rose to 120°.

EXPERIMENT No. 2.
Fire test of oil, 111°.
Temperature of room, 68°.
Temperature of oil taken, 68°.
Lamp with Sun Burner No. 2.

In four hours the temperature of the oil rose to 88°. I then removed it to a room, the temperature of which ranged from 100° to 104°.

At the end of first hour the temperature was 102°.
" " second " " " 106°.

The mercury was still rising slowly, but I was obliged to stop the experiment.

EXPERIMENT No. 3.

Temperature of the room, 62°, and continued the same.
" " oil taken, 61°.

Fire test of oil, 134°.

Sun Burner No. 2.

After burning 1 hour the temperature was 73°.
" " 1½ hours " " 76°.
" " 2 " " " 80°.
" " 2¼ " " " 81°.
" " 2¾ " " " 84°.
" " 3 " " " 84°.

EXPERIMENT No. 4.

Circumstances the same as in No. 3, except that a paper shade was used.

After burning 1 hour the temperature was 82°.
" " 1½ hours " " 86°.
" " 2 " " " 89°.
" " 2¼ " " " 93°.
" " 2½ " " " 94°.
" " 2¾ " " " 98°.
" " 3 " " " 98°.

N. B. The shade had caused an increase of 14°.

EXPERIMENT No. 5.

Fire test of oil, 160°. Amount of oil taken, 16 fluid ounces.

Temperature of the room, 40°.
" " oil taken 35°.

Argand Burner.

After burning one hour the temperature was 68°; the temperature of the room at end of hour was 62°.

After burning 1¼ hours the temperature was 70°.
" " 2¼ " " " " 75°.
" " 3¼ " " " " 78°.

I intended that the conditions of this experiment should approximate those of lamps burning in the morning.

EXPERIMENT No. 6.

Fire test of oil, 160°.

Amount taken, 16 fluid ounces.

Temperature of the room, 62°, and continued the same.
" " oil taken 62°.

Argand Burner.

After burning 1 hour the temperature was 71°.
" " 1½ hours " " 79°.
" " 2 " " " 80°.
" " 2½ " " " 81°.
" " 3 " " " 81°.

Up to this time the bulb of the thermometer had dipped into the oil. I now raised it just above the surface of the oil.

At the end of ¼ hour the temperature was 84°.
" " ½ " " " " 85°.
" " ¾ " " " " 85°.

Whole time of burning, 3¾ hours. Oil consumed, 5 ⅝ fluid ounces.

EXPERIMENT No. 7.

Same conditions as in No. 6, except the use of Sun Burner No. 2.

After burning ½ hour the temperature was 70°.
" " 1 " " " " 74°.
" " 1½ hours " " 77°.
" " 2 " " " 79°.
" " 2½ " " " 79°.
" " 3 " " " 79°.

Up to this time the bulb of the thermometer had been partly immersed in the oil. I now raised it just above the surface of the oil.

At the end of ¼ hour the temperature was 85°.
" " " ½ " " " " 85½°.
" " " ¾ " " " " 85½°.

Oil consumed in 3¾ hours 4⅜ fluid ounces.

EXPERIMENT No. 8.

Fire test of oil 160°.
Temperature of oil 62°.
" " room 125° to 130°.

After burning ½ hour the temperature was 101°.
" " 1 " " " " 128°.
" " 1½ hours " " 137°.
" " 1¾ " " " 142°.
" " 2 " " " 142°.

So far the bulb had been wholly immersed in the oil. I now raised it just within the surface of the oil when the mercury promptly rose to 146°. Within the next quarter of an hour it rose to 147°, and became stationary at that point. I now raised the bulb above the surface of the oil when it fell to 145°, and remained at that point. During the last hour the temperature of the room averaged 128°.

"I have tried to determine the following points:

"First.—Which will generate more heat, a high or low grade oil? This would have been shown by comparison of No. 1 and No. 6, had I not, through mistake, taken the room at different temperatures.

"Second.—Which will consume more oil, the Argand or No. 2 Sun Burner? Comparison of No. 6 and No. 7 shows a difference of more than 25 per cent against the Argand.

"Third.—Which will produce more heat, the Argand or the Sun Burner? Comparison of No. 6 and No. 7 shows only half a degree, but the Sun Burner increased in temperature more rapidly at the start than the Argand.

"The experiments No. 6 and No. 7 were designed to give the results that would be found in temperature of an ordinary sitting room (62°).

"No. 2 (100° to 105°), those found in many kitchens.

"No. 8 (125° to 130°), those in engine-rooms, etc.

"No. 4 the use of a lamp shade.

"I do not know as all this amounts to much, but it shows clearly that the 110° test oil is far from safe."

These experiments of Mr. Coleman are very valuable. I would especially

call attention to two facts which he brings out, which no other experimenter has established, so far as I know: First—The large increase of temperature in the oil in a lamp by use of a lamp shade, and, Second,—That the vapor above the surface of the oil in a lamp may have a much higher temperature than the oil itself. No. 6 and No. 7 show this very clearly, where the temperature of the vapor is 4° to 6½° above that of the oil.

Second.—Low grade kerosenes are unsafe because they are liable to take fire when sold in the shops. The following, taken from the Detroit Post of Dec. 1st, 1873, is a case in point:

"On Saturday evening, shortly before 6 o'clock, an accident occurred in this city resulting in the destruction of several thousand dollars' worth of property, the severe burning of one person and the narrow escape of others, that is to be attributed directly to the wretched traffic in dangerous and illegal oils, heretofore vigorously denounced in these columns. In this case, however, there was a sort of poetic justice, the principal sufferer being the vender and not the purchaser of the stuff. At the hour mentioned Casper Schneider, the proprietor of a grocery store, at the corner of Fort and Beaubien streets, was waited upon by a customer who called for half a gallon of kerosene oil. Taking the oil can and a lighted lamp, Schneider went down cellar, where the oil was kept, and setting the lamp upon the floor close to the barrel, commenced drawing the oil. All at once there was a flash and an explosion. Schneider was badly burned about the hands and face, while the burning oil set fire to everything around that was combustible. He ran up stairs and gave the alarm, but the flames gained headway with almost incredible rapidity, and soon the greater portion of the building was wrapped in flames. The owner of the building, Mr. John Dunnebeck, who lived in the third story, undertook to descend by the stairs, but found escape cut off by the flames, and rendered almost desperate by fear and excitement he opened a back window and jumped to the ground, sustaining a few bruises but no severe injuries.

"After all the inmates of the building, as it was supposed, had made their escape, it was discovered that a little 4-year-old neice of Mr. Schneider was missing. Two or three men rushed into the burning building, at no little danger to their own lives, and brought the child out. She was nearly suffocated by the smoke, and was badly frightened, but not seriously injured. The damage to the building, which was a three-story brick edifice, was about $1,000; insured. Mr. Schneider estimates his loss on stock at from $3,000 to $5,000; insured for $2,300.

"If the oil sold by Mr. Schneider had been up to the standard fire test, the accident would not have happened. It is very likely that he may have been ignorant of the quality of the oil, inasmuch as the market is flooded with cheap and inferior brands, manufactured in Cleveland, the most of which will take fire at from 90° to 100° Fahrenheit. It is to be hoped that the authorities will open a vigorous campaign against the dealers in these dangerous and illegal oils."

Third.—They are unsafe because they are often used carelessly. The accident that occurred to Charles Anglewitz in Detroit, Jan. 5, is a case in point. I am indebted to Dr. C. C. Yemans, of Detroit, for the following.

DETROIT, Jan. 20, 1874.

Sunday, 5th inst., Charles Anglewitz was seriously burned, in a house, corner

Prospect and Marion streets. Anglewitz's statement: "I was alone in the house at 7 P. M. I went to fill the lamp while it was burning. After removing chimney, etc., I had lamp in one hand and the small tin can in the other. While pouring, the oil took fire; covered with oil and flame, I ran for the door, but could not open it. I tried another door and escaped. I then walked to my sister's where I now lie." I was called at 9 P. M.; found patient suffering intense pain. He was burned only on hands and face. I feared my patient would die from acute inflammation of fauces and air passages from having inhaled the flame. His tongue was swollen and protruding. * * * I cannot give prognosis as regards the hands, but fear the left hand must be amputated.

Oil manufactured at Cleveland: bears Fowler's brand, 150°. Oil bought by retail dealer from Farrand & Williams. Explosion was heard 500 feet. The house was ignited but fire was extinguished.

Yours respectfully and fraternally,

C. C. YEMANS, M. D.

I visited Detroit the day after the accident, and Tuesday morning, in company with Dr. Lyster, visited the patient; also the room in which the accident occurred, and obtained a specimen of the oil. I have since inspected the oil and find it flashes at 116°, and takes fire at 126°.

Persons may say that Anglewitz was very careless in attempting to fill the lamp without first extinguishing the flame. Unquestionably; but if the oil had been in fact what the brand represented, no accident would have occurred.

In order to test the liability to accidents by breaking lamps filled with oils of various grades, I took a number of lamps, filled one with benzine, lighted it, and broke the lamp without extinguishing the flame. The oil instantly took fire and burned with great violence; the flame could only be extinguished by smothering. Another lamp, filled with oil that flashes at 90°, but bearing the inspection mark: "Warranted 150° Fire Test, J. J. Adams, Inspector," when treated in the same way, ignited the oil at once, and burned with great vigor. Another lamp, filled with oil at 110° flashing point, was lighted and broken, when the oil ignited and burned with energy. Another lamp was filled with oil that flashes at 120°; when lighted and broken the oil did not ignite; but a second lamp, treated in the same way, fired the oil. A lamp, filled with oil that does not flash below 150°, when broken, did not ignite the oil, and the flame of the wick soon expired. These results need no commentary.

No oil is safe which will give off an inflammable vapor at the highest temperature ever reached in lamps, or which will burn when a flame is applied to their surface at such temperature.

Oil that will bear the Michigan test of 150° is safe under all circumstances. Oil below this standard may be safe in certain circumstances; but on so *vital* a point as life, the wise man will prefer certainty rather than probability.

I cannot close this article without expressing my thanks to the Press of the State for the cordial support they have given to the State Board of Health in their efforts to secure to the people health and life.

Lansing, January, 1874.

POISONOUS PAPER.

BY R. C. KEDZIE, CHAIRMAN OF COMMITTEE ON POISONS, SPECIAL SOURCES OF DANGER TO LIFE AND HEALTH, &c.

The attention of people was called to the danger of poisoning from the use of wall-paper, etc., colored with arsenical pigments, in an admirable article by F. W. Draper, M. D., in the Report of the State Board of Health of Massachusetts for 1872. It might seem that it would be superfluous to again call attention to this source of danger; that there can be no originality in again sounding a note of warning, and that people will resent this reiteration,

"Weary as a thrice-told tale,
Vexing the dull ears of a drowsy man."

But thankless as is the task of repetition, I feel that in this case it is necessary. People when reading of any danger at a distance are apt to think that it will remain at a distance, and to regard the matter very much as they do an account of the irruption of Ætna, or an earthquake in Peru,—a danger that will never reach them. If persons have been poisoned by wall-paper in France and England, and even in Massachusetts, that is a matter of no personal concern to them, as they do not expect to visit these distant places. But when people learn that this danger is as imminent in Michigan as in Massachusetts, when they realize that the danger is "nigh, even *within* their doors," they will be on their guard, and life and health will be more secure.

It is for the purpose of calling attention to the danger arising from the use of arsenical greens, even in this State, and to show how much good can be accomplished by directing attention to this subject, as was done by Dr. Draper, that I write the present article.

The two sets of cases I present are not to be considered as the only ones which have occurred in this State. Doubtless many cases are never recognized, and the patient goes lingeringly down to his grave, and he is supposed to be following that too well-beaten path,—"a general decline." I know of a number of additional cases where I have reason to suspect that chronic ill-health has resulted from slow poisoning by wall-paper, but the evidence is not sufficient to justify me in presenting them to the public.

But it is not alone in wall-paper that danger of this sort lurks. A professor at the Agricultural College brought home a package of lead pencils around which was a broad band of beautiful green paper. His little children, attracted by the beautiful color of this paper, wanted it "to play with;" but he handed

it to me for analysis, and I found it contained enough arsenic to poison all of them. A physician in Lansing on returning to his home found his baby with a box of playthings before him; the box was ornamented with a wide band of paper passing around the top, colored green with Schweinfurt green, a substance which would readily adhere to the moist fingers of the baby, and the frequency with which the fingers are transferred to the mouth would give rise to danger of poisoning. I received a package by the United States Express Co., on which was their green label. On analysis this gave abundance of arsenic. The green tags with which merchants mark their goods are almost always poisonous from the presence of the aceto-arsenite of copper, or the Schweinfurt green. These poisonous greens, all the more dangerous from their bright color, are to be found on all sides, and "eternal vigilance is the price of" safety.

Some persons have said that it is a very simple matter to avoid all such dangers,—that all we have to do is to reject all greens. But not all greens are poisonous. Many do not contain a single trace of arsenic. Then again, many papers are loaded with arsenic in which no distinct green color is discernable, the arsenical green being so combined with other pigments as to conceal its characteristic color, giving a tone to the ground work of the paper, which is very soft and agreeable to persons of good taste. By examining, with a good magnifying glass, the specks of green may often be seen, but no person who had not had his attention directed to the subject would suspect the presence of arsenical green in such subdued colors. I have a sample of such paper used in decorating the walls of a room occupied by a physician in Lansing, and only regret that I have not enough to bind up a specimen in each volume of this Report, that it might put people on their guard against these soft-toned but insiduous colors.

HOW TO DETECT POISONOUS WALL-PAPER.

The detection of poisonous substances belongs to the practical chemist, and in his hands only will such examination be entirely satisfactory. I shall not give all the tests, or even those which are most delicate in their reactions, for these require skillful manipulators.

If the color is a bright grass-green it may safely be rejected at once. If a little ammonia water poured on the paper discharges the green color, or produces such a change in the color as indicates the removal of green, it should be rejected. The two arsenical greens, Scheele's Green, and Schweinfurt Green, are readily soluble in ammonia water, the water acquiring a bluish tint. Other compounds of copper are also soluble in ammonia water, but they are not much used in paper hangings. If you wish to identify the arsenic, drench a piece of the paper in a little ammonia water, pour off the clear water and drop into this a crystal of nitrate of silver; if a yellow precipitate forms around the crystal it indicates arsenic.

HOW DOES IT POISON?

Every intelligent person recognizes the fact that arsenic is a deadly poison, and every physician knows that all the compounds of it are more or less poisonous. The question arises, how does the poison in wall-paper enter the system of those occupying the room? Several theories have been advanced to explain this. The popular notion that the white oxide of arsenic or "arsenic," as it is commonly called, is volatile at ordinary temperatures, and that the vapor of this substance pervades the air of the room and is inspired in breathing, is without good foundation. According to Miller, white arsenic volatilizes at 380° Fah.—a temperature never reached in the walls of an inhabited room. I have spent years in a room containing white arsenic and a great variety of arsenical combinations, without any symptoms of poisoning.

Many chemists of eminence have advanced the theory that the poisonous influence arose from decomposition of the size by which the pigments are attached to the paper, the paste by which the paper is fastened to the wall, or the substance of the paper itself; that the hydrogen formed by such decomposition unites with the arsenic and forms a gaseous substance called arseniuretted hydrogen. This gas is known to be a deadly poison, and when breathed in quantities it rapidly causes death. When the walls of a room are damp it is possible that this gas may be formed, and if it is present in the air of a room, even in very minute quantity, its influence will be very deleterious.

The possibility of the formation of arseniuretted hydrogen in wall-paper suggests the advisability of removing entirely from the walls of a room any paper known or suspected to contain arsenic. Some persons suppose it is sufficient to cover up the poisonous paper by another free from arsenic. The walls of a room covered with several thicknesses of paper containing glue and starch paste will be in a condition to produce putrefactive decomposition in the presence of moisture, and such walls may be a concealed source of much ill health. It is much safer to remove such possible source of disease entirely. "Cast out the bond woman and her son."

The most probable mode, and the one now generally recognized, is that the material is dislodged from the paper in the form of fine dust, which, floating in the air, is inspired by those occupying the room. This is made more probable by the fact that the dust in such rooms is found to contain arsenic. The coloring matter of most of the wall-paper is so feebly attached to the paper that it can readily be detached by rubbing it with the hand or a cloth. Paper that has been some time on the wall is usually found to be somewhat faded in appearance,—not from any change of the coloring matter, perhaps, but because the coloring matter has been removed. The paper in one room I examined did not look faded in color, but when a piece of fresh paper was compared with that which had been on the walls of the room eighteen months, the loss of coloring matter was very apparent. The owner declared that half the col-

oring matter had left the paper. Yet, the paper on the walls of this room originally contained six ounces of arsenic, and if his estimate was correct, then an ounce of arsenic every six months had been dislodged from the walls of his bed-room.

This suggests a caution in removing such poisonous paper from the walls of a room, viz.: to avoid inhaling the dust during such operation; the walls should be thoroughly wet to prevent dust, and the windows should be open to allow any dust which may form to freely escape from the room.

CASES OF POISONING.

The first cases I will notice were the two children of L. D. W———, of Manchester, Mich., formerly a State Senator. The walls of one bed-room were covered with a paper the ground work of which was stone color with bands of bright green ornamented with gilt. The daughter, Emma, aged 9, occupied this room for several months. Soon after occupying the room her health began to fail, and she exhibited the following symptoms: Lameness, resembling rheumatism, darting pains in various portions of the body; languor in the morning, feverishness, pains in the head and about the frontal sinuses, sores in various parts of the body, faint spells, turning white about the mouth, and great loss of flesh. The best medical advice that could be procured was obtained, but no essential improvement followed. Whenever she left home for a few weeks her health improved; but she relapsed into her former condition on returning home.

The late Miss Caroline A. Howard of Lansing, visited the family, and on her return home spoke to Dr. Baker, present Secretary of the Board of Health, of the peculiar sickness of Emma. He directed her attention to the report of the Board of Health of Massachusetts, for 1872. Soon after, Mrs. W—. visited Lansing and her attention was directed to Dr. Draper's article on poisonous wall-paper. She was so thoroughly convinced that the wall-paper was the occasion of Emma's sickness that she cut short her visit to hasten home to rescue her daughter from this poisoned room. Some of the paper was sent me for analysis. The body of the paper contained a small amount of arsenic, but the most was found in the bright green stripes. The paper averaged 4.87 grains of arsenic to each square foot of surface. Emma was removed from the room and entirely recovered her health.

The room was not used for about a year, but last fall the son Herbert, aged six, because he disliked to sleep alone, was allowed to occupy this room, which adjoined his parents' sleeping room. In a short time all the distressing symptoms which afflicted Emma were developed in Herbert. On removing him to another room he entirely recovered.

The second set of cases occurred in the family of Dr. B——— of Lansing, a very intelligent physician, a member of the House of Representatives in our State Legislature, and chairman of the committee which introduced the

bill establishing the State Board of Health. Dr. B——— was fully aware of the danger of using arsenical wall-paper. The paper on his bed-room walls had a very few small flowers of bright green, which he recognized as containing arsenic, but there was so small a surface of this kind that he apprehended no danger from it. The color of the body of the paper was gray with a shade of sea-green, but the color was so faint that he had no suspicion of its containing arsenic.

The doctor had been troubled with rheumatic troubles for some time. pains in the bones, and some cough. His two little boys occupied the bed-room next to his, and the door between the rooms was open at all times. The boys became affected with rheumatic pains and soreness similar to their father's. Suspicion becoming aroused that the wall-paper might have some connection with this derangement in their health, a specimen of the paper was sent me for analysis, and I found 5.47 grains of arsenic to each square foot of surface; or six ounces of arsenic on the walls of a single room. The faint sea-green tint was imparted by the Schweinfurt green, and the body of the paper being thus colored, the aggregate was large.

The paper was immediately removed, and the doctor looks better; but the time is too short to speak with confidence of the result. His boys have been sick with chicken-pox, so that no decided opinion can be given in regard to the influence of the change on them.

The point of especial interest in this case is the fact that the arsenical color was so disguised by combination with other colors as to deceive even the practiced eye of an acute physician.

SCHOOL BUILDINGS:

IN RELATION TO THEIR CONSTRUCTION, WARMING, AND VENTILATION, AS INFLUENCING THE HEALTH OF TEACHERS AND SCHOLARS.*

BY R. C. KEDZIE, CHAIRMAN OF COMMITTEE ON BUILDINGS.

The Committee on Buildings will, in this Report, only consider the subject of School Buildings, reserving for future consideration, dwellings, public halls, etc.

The subject of School Buildings, as connected with the health of their occupants, has attracted but little attention in our State. The mighty task of "subduing the earth," of hewing out from the forest, homes and fruitful fields, has occupied the thought and effort of our population. But we have now reached that degree of advancement which will justify a more careful consideration of the conditions of health. These considerations bear with especial importance upon the conditions affecting the health of children; for a healthy childhood naturally ripens into vigorous manhood, while sickly childhood leads to premature old age, or early death. By securing the best possible conditions for the health of the young, we most effectually secure the well-being of the State; and any cause which saps the vigor of childhood is a blow at the common weal. Under the action of our civil laws, we have almost nothing to do with the conditions of health in private houses. Every man is lord of his own castle, and he may make it as unhealthy as he will. But with the conditions of health in the public school, the officers of the law are almost omnipotent. The public school is almost the only place where the law may directly interpose to secure for the people the conditions of health. By law we have made attendance on school compulsory; by the potent law of an enlightened public opinion we should also make compulsory the conditions necessary for vigorous health during their attendance on school. Many of these scholars come from homes poorly constructed, badly ventilated, and inadequately warmed. By placing them, during the most formative period of their existence, in school buildings which combine all the best conditions of physical existence, as well as intellectual development, we do much to mold the character and modify the home life of coming generations. The "unconscious tuition" of the scholar's surroundings at school may be one of the most desirable, though most impalpable, elements of his education. Every

* A large part of the following article was presented as a report to the State Medical Society at its meeting in June, and published in their Transactions. It is presented in substance (with large additions of new matter), because of the importance of the subject.

consideration, therefore, demands that we give most earnest heed to the conditions which influence the health of the children,—the men and women of the immediate future of our State.

FAULTS OF CONSTRUCTION OF SCHOOL-HOUSES.

I.—OVERCROWDED ROOMS.

In examining the school-houses of our State, the first prominent fault in construction observed was that the rooms are too small for the number of scholars, and as a consequence, overcrowding of the rooms. The lowest estimate would require 300 cubic feet of space and 25 feet of floor space for each scholar. Thus a room 30x30 feet, and 12 feet high, might contain 35 scholars and the teacher; but this is a minimum space even for small scholars, and can be safely used only in connection with good ventilation. Some persons seem to think that small scholars require but small breathing space, but this is a grave mistake. Mr. Simon says: "It is to be desired that laws and regulations as to overcrowding should not proceed on the assumption that children (to any reasonable extent) require less breathing space than adults. Against such assumption this fact has to be considered, that even healthy children, in proportion to their respective bodily weights, are twice as powerful as adults in deteriorating the air which they breathe. I think it best that children and adults should be deemed to require equal allowances of air and ventilation." The rapidity of the processes of waste and repair in childhood forbid the use of less space. Yet when we measure the size of school-rooms and count the number of scholars, we see that the space for each scholar is much below this estimate.

School officers do not defend the frequent practice of overcrowding, but offer as an excuse that they have more scholars than their school-rooms will accommodate. This might be offered as an apology for some temporary emergency, but not when the same overcrowding is continued year after year, and no adequate provision made for remedying the evil. The economy which hazards the health and life of the pupil to save the expense of additional buildings, is an economy which borders on recklessness or crime.

The evil of this system is especially manifest in the stinting of floor space. The seats are placed as close as the scholars can conveniently sit, and the space for the alleys is as small as will allow the scholars to pass, single file. For the health of the scholar, the floor space is almost as important as the cubic space in the room. School officers often aim to increase the cubic space, while restricting the floor space, by making the rooms high between floor and ceiling. The lofty room only modifies one evil by introducing another, viz.: the necessity of climbing long flights of stairs.

II.—LOFTY SCHOOL-HOUSES.

The height of school buildings, the amount of stair-climbing which they necessitate, and the influence of such stair-climbing on the pupils, both during

their school days and in after life, are subjects which have attracted far less attention than their intrinsic importance demands. In cities the great cost of land on which to erect school buildings seems almost to necessitate the construction of buildings of many stories. The restricted amount of money voted by tax-payers for school purposes will often compel the school officers to economize in the matter of school buildings, and they naturally will economize in the direction which will give the best immediate results, viz.: by buying a small lot and putting up a big house. To secure adequate floor space, many stories are required; and to compensate for crowding the scholars on this floor space by providing adequate cubic space, the rooms are made "high between joints." The result is numerous and long flights of stairs. The many stories and lofty rooms afford a building susceptible of fine architectural proportions, which please the eye of the thoughtless observer. But the evil does not stop with the city. When school buildings are to be erected in village or country, the pleasing impression of the lofty architecture of the city naturally leads to the construction of similar lofty structures. They "want a school-house just as handsome as they have in the city." They fear to incur ridicule for building "low and squatty" buildings if they are only one or two stories high, and hence lofty school buildings are becoming the rule in city and country alike. But this servile copying of city customs, where the conditions which made it necessary in the city do not exist in the village or country, does not indicate refinement or good taste. It is very much like the villager putting his dining-room in the basement because his wealthy friend in Boston has his dining-room below.

The city boards are guilty of a wasteful economy when they save ground space by carrying their buildings skyward; but the village and country school officers are utterly without excuse for following so bad an example, because with them land is abundant and cheap, and hence there is no excuse for lofty buildings. Here in Lansing, where they have an entire block of four acres on which to erect a new school building, it must be three stories high, lest "folks will laugh."

Sometimes the evils of these lofty structures are still further increased by placing the building on some hill-top or bold headland, making necessary a still greater amount of climbing. The evils of this faulty construction are still further increased by the almost universal custom of sending the more advanced and older classes to the higher rooms, so that the girls as they approach or reach the period of puberty are day by day and many times a day climbing to the highest floor of the building. If this useless custom of sending the advanced classes to the highest floors, were abandoned and the younger classes sent aloft, the girls at the most critical period of their life might be kept upon the first floor, and a great evil thus avoided, even with the present faulty construction of school-houses.

A late number of The Nation, in reviewing Dr. Clarke's "Sex in Education," says: "It is an unquestionable fact that the health of American women has,

on the average, distinctly deteriorated during the past forty years. The delicate beauty of American girls quickly fades; the diseases peculiar to women are commoner than they used to be, and women of the educated classes are less able than formerly to bear and nurse children. The medical profession testifies with singular unanimity to this sad truth; common observation corroborates their testimony, and the census adds its statistics to complete the unwelcome demonstration. Moreover, the sterilizing influences, whatever they are, undoubtedly affect the refined classes more strongly than the ignorant and rude. The women who are morally and mentally best fitted to perpetuate and improve the race, are precisely those who are physically least likely to do so. It is imperative that the American community should be awakened to the gravity of this danger, and be instructed in the means of avoiding it."

This is not a cheerful view, nor does it give us a flattering outlook for the future of the American race. Its one redeeming (?) feature is that it is true.

When we look for the causes which explain any known evil, we usually find that many concurrent causes unite to produce the result. It is seldom that we can trace in society any great evil to the action of one sole cause. The causes which produce this early fading of American women are the same which cause their precocious development. Early maturity is a physical antecedent of early decay. The girls of the tropics are said to be women at 10 or 12, and withered old women at 30.

The causes which produce this early development of girls are partly climatic and partly social. Among the social causes of early decay Dr. Clarke places the continuous strain of school life, which affords no opportunity for rest and recuperation at the monthly periods. There is great force in the Doctor's arguments; the only difficulty is to devise a course of study even in a girls' school which shall be successful while liable to the interruption of classes by one and another dropping out for a week as nature may demand. If we could only bring the girls all into line! Without this, the course of instruction would be individual rather than by classes.

But giving Dr. Clarke's positions all the force which they claim and deserve, I think there is another cause still more disastrous in its effects, not only after, but before puberty; and that is the influence of stair-climbing on female health, or in more general terms, all those influences which tend to produce or aggravate congestion of, or at least an unusual supply of blood to the contents of the pelvic cavity. The unusual supply of blood to any organ tends to accelerate its functional development, or modify its functional activity when fully established. The uterus and its appendages remain in nearly their embryonic state of development from infancy till near the catamenial epoch, but if by any means the conditions of active development are furnished at an earlier date, the uterus may assume its peculiar activity much in advance of the normal period. It has been stated that the use of the treadle of the sewing machine has had a bad influence on female health; can we doubt that a correspondingly severe use of

the lower extremities in stair-climbing would be alike prejudicial? But the same causes which will aggravate the menstrual flow will also tend to the earlier establishment of the menses. According to my somewhat limited professional observation, the girls of to-day, especially among the educated classes, attain puberty at a much earlier period of life than formerly. Fifteen is considered the normal age, but it is by no means rare to find the menses established at 12, or even at an earlier age. If we assume that the second climacteric period will be reached at thrice the age of the first climax; then the girl whose menses are established at 12 will have survived the period of active womanhood at 36 instead of 45. That is, each year of precocious puberty will subtract 3 years from the characteristic life of womanhood. I throw out these suggestions, not as established facts, but as possible explanations of the early decay of American women.

But whether stair-climbing is to be considered a cause of too early development of the sexual system or not, consider its influence on young girls just before and at the period of puberty! Consider the necessary penalty which woman must pay as the price of her erect posture! If her body was not erect, but horizontal at all times, like quadrupeds, the tendency to displacement of the contents of the pelvic cavity would be no more than in the lower forms of animal life. But with the uterus in such anatomical position that there is but slight resistance to the force of gravity which constantly tends to drag it downwards, the broad and round ligaments affording it but very imperfect if any vertical support, the elastic contractility of the upper walls of the vagina giving only sufficient support to sustain it under ordinary displacing forces, how dangerous becomes the addition of any other displacing force! But at the establishment of puberty, the uterus is rapidly increased to thrice the volume it possessed in childhood, and the supports, not yet accustomed to bear their triple load, have also to bear the shock which the body sustains in arrested motion, as in climbing and especially in descending stairs. The uterus, under such irritant causes, becomes congested, swollen, heavier, and tends to descend still farther; the irritation extends by continuity of surface to the upper walls of the vagina, which become weakened and still more incapacitated to sustain their increased and increasing load; and thus is laid the foundation of disease and suffering which shall last for weary years, and perhaps for life. As if to intensify and aggravate the evils naturally incident to this most critical period of woman's life, we are sending her, four times a day, up and down long flights of stairs; sending her to the topmost story of our lofty school-houses.

Those who are familiar with the anatomy of the human frame and the physiology of the female organs, will acknowledge that I have drawn no fancy picture; Anatomy and Physiology emphasize every word I have written. But when I appeal to physicians, when Pathology takes up the pencil, how fearfully distinct become the lines of this dark picture! How few women of our acquaintance, during the active life of womanhood, are perfectly healthy,

especially among the educated and refined,—those who have been attendants on our higher schools! This is a delicate subject to discuss, and reverence for the female sex would lead me gladly to pass over it in silence but for the fact that the evil is most formidable and bids fair to go on increasing, if something is not done to arrest it by removing one of its efficient causes. Women themselves are often ignorant of the causes which tend to produce the diseases peculiar to woman. From native modesty she is averse to bringing into notice the sufferings which are peculiar to her sex, more especially when she supposes that they are the normal lot of her sex, and has learned to bear in silence the evils which she has learned to consider inevitable. But when we consider that much of this evil is preventable, and when we see men erecting school-houses and seminary buildings which will curse and blight ages yet unborn, our pity rises into indignation. A lofty school building placed on some bold headland, is picturesque; but a woman broken in health, and blighted for life from the very hour of budding womanhood is not picturesque! The pleasure we may take in architectural display is a poor recompense for the long years of suffering and agony. "Bad, however, as are the immediate effects of this system, they are as nothing compared with their remote effects,—the sickly race that comes" of suffering and disease.

Almost every teacher, whom I have consulted, reprobates these lofty school-houses in strong terms. One of the first teachers in the State said: "Stair-climbing very frequently gives rise to female complaints, or aggravates the condition already existing. Many girls ask to be excused from writing and drawing (on the third floor), from this cause." Another who stands at the head of one of the first educational institutions of the State, said: "Stair-climbing is very injurious to many of the girls, especially as the period of puberty approaches, and following this period. *It has been a great damage to the school.*" The testimony of all the teachers whom I have consulted personally, confirms the foregoing statements. I have also written to many of the most prominent educators in this and other States, and I give extracts from the replies received. If I could give the names of the writers the extracts would have still more force.

One writes: "I seldom allow the same ladies to room on our third floor during the entire year, and a young girl of 15 or 16, who has not yet, or who has just arrived at womanhood never rooms there if it is possible to find a room for her on other floors. * * * It seems to me that children from 8 to 12 years old could better climb stairs than older persons."

Another says: "If my opinion is of any consequence, I would say that if the West would imitate the East in lofty buildings, they must provide *elevators*, and keep them in constant use." *

Another, after having read my report to the State Medical Society, writes:

* In one College in this State an elevator has been introduced, to save the ladies from this excessive stair-climbing.

"I approve most emphatically of all you said in regard to stair-climbing by young girls over fifteen. My views have agreed with yours for the past twenty years. Hence when building, some 18 years ago, I was decided in having all my recitation and school-rooms on the first floor. Our dormitories are only in second and third stories, and I wish they were only one story above the school-rooms. I see that your statements were fortified by the views of several teachers, so I presume you will not at all need anything further from me on the subject. I trust what you said may put a stop to this growing evil."

Another writes: "I am very glad to give my testimony against lofty structures for school purposes. All of those who come to us have reached the stage which you designate as the 'establishment of puberty.' Most of them, I would say, are 'established in adult life.' My observation therefore has not embraced the first class you mention. It is my opinion that the pernicious effects of stair-climbing are more felt in after years than during the time young ladies are with us. As teachers we have always felt great anxiety about the influence of so many stairs upon the health of girls of delicate organization. This has been awakened, not only by the effects which we have seen produced, but by the almost universal solicitude of parents, and the conviction of so large a number of our pupils that it would be injurious to 'room high.' Several of those with whom I have been associated in teaching, have suffered much from diseases peculiar to my sex, and have felt that these were greatly aggravated, at least, by the necessary passage up and down long flights of stairs. I have known other ladies who were invalids for life, and who had passed through years of suffering from these diseases, contracted by this same process of stair-climbing while at school. It is not strange, therefore, that we have come to greatly deprecate seminary buildings of three or four stories above the basement, and we hardly need to say that we should hail with much joy and relief an era that would give us more ground surface and fewer stairs. The friend with whom I am staying was Principal of the seminary at * * * for seven years, and fully endorses what I say."

Another writes: "I am glad of the opportunity of entering an emphatic protest against 'lofty school buildings.' A boarding-school experience of nearly sixteen years has led me to believe that they are a fruitful cause of diseases peculiar to women, and that young girls of the age you mention are peculiarly liable to be injured. They come from home, ignorant of the evil consequences of their heedless and often needless running up and down stairs; they are burdened with heavy skirts suspended from their hips, and the 'precept upon precept' from their teacher is forgotten almost as soon as spoken. They are often predisposed to weakness, and the tendency is confirmed by stair-climbing. * * * * We have here a building four stories high above the basement, in which is the dining hall. For seven years the fourth story has not been occupied. The third story is filled with the greatest difficulty, because the pressure is so great for lower rooms from the requests of friends, and the actual necessi-

ties of the case. In consequence, we are crowded on the second floor, three often occupying a room designed for two. One of our regulations enforced strictly, is to prevent *running* up and down stairs. We are able in this way to prevent much injury. I cannot mention cases where injury could be traced exclusively to stair-climbing, but I know it is injurious, especially to very young girls. The proportion of those who are subject to irregularities in their menses, and to tendency to displacements, is increasing every year. They enter school thus diseased, or with tendencies to disease, and for such, stair-climbing must be only harmful. I might even go farther than to say the proportion is increasing. I might almost say that the proportion who are entirely healthy in these respects are the exception and not the rule.

I shall be interested in knowing the result of your inquiries, and I hope that you may do something to check a great and growing evil. It is almost a daily desire with me to take down our own lofty building and build it over on principles more truly sanitary; and since that is impossible, it is a daily burden how to use it so as not to do harm to the bodies of those who are committed to our charge."

No words of mine could add force to such testimony from such witnesses. I am gratified that public opinion is being aroused to the importance of this subject. I have received some letters on this subject, of which the following is a sample:

"We have in this city about 12 school buildings, most of them of modern architecture and plans, and are about to build and remodel more,—and the question has come up as to how many stories high we shall build, and how ventilate. A special committee has been appointed to look into and report to our Board of Education, especially in reference to the number of stories high we shall build our new houses,—2 or 3 stories. Economy says three stories. But the question came up as to the health of sending scholars up so many flights of stairs, *especially* to young ladies and girls. I would like your views on this point in particular, and any reference to works touching this particular question."

Another writes: "Will you do us the kindness to give us, at your earliest convenience, what information you can upon the hygienic effects of climbing long flights of stairs, as is the present practice in our public school buildings?"

Since the above was written my attention has been called to the case of Miss R., of Hillsdale, reported by Dr. Geo. E. Smith, to the Southern Mich. Medical Association, at its meeting Dec. 9th, 1873. The report is published in the Peninsular Journal of Medicine, for January, 1874, pp. 320–324. The report is too long to quote in this note, but I give the results of autopsy. "Within the pelvis, the womb, the ovaries, the rectum, and the sigmoid flexure of the descending colon, the broad ligament, the fallopian tubes, and bladder, all adherent from inflammation, the left ovary one mass of pus, the right two-thirds destroyed, and in the same condition as the left. Within this agglutinated mass seven pockets were formed, all filled with pus. We were obliged to

carefully dissect the organs apart." "The cause of all this trouble may be dated to the constant going up and down the stairs of a four-story building with a basement under it in which the dining hall is located, producing falling of the womb; a neglect of proper treatment, a will which would not give up, even when every step was a prolonged misery, and flesh and heart failed."

"This woman was a martyr to her modesty, and to her conviction of duty, doing work beyond her strength, and hiding her pain until the whole system rebelled and sunk under its load of distress."

"Dr. Whelan related the history of several similar cases."

It is useless to mince our words in commenting on such a case. This noble and heroic woman *was killed by stair-climbing.* How many scores of young women are now suffering martyrdom from the same cause, or have passed in silence to the grave.—"They died and gave no sign!" How significant the closing line of the above extract: "Dr. Whelan related the history of several similar cases." If every physician in the State should relate the cases which have fallen under his observation, what a ghastly array would be presented. And yet we boast of our lofty school-houses, "the glory and pride of our Peninsula!"

The motto of officers having the charge of erecting school-houses seems to be "Excelsior,"—*higher!* This may be a good motto for aspirations in social and literary culture, but school boards should remember that this alpine youth in his persistent climbing *went up to the stars*, and our beautiful girls will go that way all too soon without being hastened on the road by homicidal methods in school architecture.

III.—LARGE OR SMALL SCHOOLS.

Shall a city aim to have a few large schools or many small ones? It seems to me that too little thought has been given to the influence of large schools on the health of scholars; that the sanitary condition of a child in a school of 1,000 or 1,500 scholars is very different from that of a child in a school of 100 or 200. We all recognize the fact that the conditions of life in a large city are usually less satisfactory than in a village or in the country. Do not correspondingly deteriorating influences surround the child in every large school? Adequate ventilation and satisfactory heating can be more easily secured in buildings of moderate size than in very large buildings. The same can be said in regard to the sewerage, and insolation, or the needed exposure to sunlight.

It is conceded that a teacher should have the direct supervision of only a limited number of pupils. In large cities, where the grading of the scholars can be more satisfactorily accomplished than in smaller places, why cannot those of the same grade or similar grades be placed in one building, and thus in more immediate charge of their teacher, instead of grouping a large number of grades in one large building? We should thus have a large number of medium-sized schools in place of a small number of colossal schools. Could

not the sanitary conditions be better observed in these smaller schools, and many social evils excluded which spring from herding together in one mass, pupils of different ages and conditions of intellectual development?

I am aware how pleasing is the sight of a vast crowd of scholars, and how beautiful is the sight of a sea of eager, upturned little faces; but is there not danger of sacrificing their well-being to our love of spectacular show?

I am not speaking of primary or ward schools, but of the graded system of our large cities. I do not wish to speak dogmatically on this point, but would raise the question whether the present tendency is not to the formation of vast,—even enormous schools, which will not subserve the best interests of the scholar so well as schools much smaller in size?

WARMING.

The proper warming of a school building is a matter of great importance. The mass of the scholars are young, and it is well known that the young of all animals, especially when not taking active exercise, require a higher temperature than adults. Much of the difficulty in warming school-rooms arises from defective ventilation, as it is almost impossible to properly warm the air of a room which is not ventilated. Air when heated expands in volume, and thus becomes specifically lighter, causing it to rise above cold air. In every room heated by artificial means, a lake of cold air tends to form on the floor, and if this is left undisturbed by ventilating currents, the result in a hygienic point of view is very undesirable. Walls, and especially windows, are another cause of cold air, and of descending currents, which are very trying to the health and comfort of those who sit near them. A person will often contract a cold by sitting near a closed window which does not admit the outside air, from the fact that the warm air of the room coming in contact with the cold glass becomes colder and hence heavier; it begins to descend along the glass, constantly losing temperature and gaining velocity till it reaches the bottom of the window with a very perceptible current, and the person is in a cold draught as truly as though the outside air were blowing through the open window. Mr. Babbage, illustrating the power of the imagination, said he had once complained that he had contracted a cold at dinner, having mistaken a plate-glass window behind him for an open one. But the cold may have been caught from the plate-glass as well as from an open window, and perhaps the power of the imagination may have been shown by his supposing that he did not take cold from the window because it was closed.

A person who has never tested, by the thermometer, the variations in different parts of a room, can form no just estimate of the remarkable variations in temperature in different parts of the same room. A physical exploration of this kind reveals the fact that the warming of a room is a somewhat complex problem. I have often found a difference of 15 to 20 degrees between the temperature at the floor and six feet above the floor. In the House of Representatives last winter an honorable member complained to me that his legs and feet

were cold while his head was uncomfortably warm. I suggested that this was in consequence of his sitting with his feet in a lake of cold air. He tested the matter with a thermometer and found the difference in temperature between the floor-level and the head-level was 14 degrees. Tracing this cold tract by his thermometer he found it led to a window directly behind him.

Infants creeping on the floor often suffer from the cold, while the mother is living in a warmer climate of the upper air. She wonders "what makes baby so fretful?" and on lifting the little sufferer she is astonished to find how purple and chilled his limbs are. Children at school often suffer in the same way. The thermometer, hung up six feet from the floor, marks 65 degrees, and the teacher pronounces the room warm enough, and attributes the complaints of the little ones to that manifestation of total depravity, "children are always complaining." With the head hot and the feet aching with cold, how can they be sweet and placid? In examining the school-rooms in this State I made frequent observations on the temperature at the floor-level and at the desk-level, and often found the difference from 8 to 15 degrees,—in one instance 19 degrees, and in another 21 degrees. In the last instance the teacher in astonishment exclaimed, "Why! we ought to keep the head cool, and the feet warm, and how am I to do it?" I replied, that the only way I could see in his school-room was for the children to stand on their heads.

I found, as a general rule, that where the rooms were not ventilated at the floor-level, and when this lake of cold air was not drained off, the difference between the temperature at the floor and the desk, that is the difference in temperature at the feet and the chest of the scholar, was seldom less than 6 to 8 degrees, and often much in excess of these figures. The warming of a room is so intimately associated with its ventilation, that it is impossible to properly warm a room in cold weather, without also ventilating it. The necessity of drawing off this cold air at the floor-level must modify our theoretical plans of ventilation. Ventilation has something more to accomplish than simply to change the air in a room.

In the December number of the Sanitarian Mr. L. W. Leeds, in a very interesting and valuable article, presents a plan for a "Sunned and Aired School House," for which he received the premium at the Vienna Exposition. He clearly shows the need of sunshine in the school-room, and points out the way to secure it. His plan for warming the room is to heat the floor and walls, and keep the air in the room as cold as possible. He says: "We should constantly have in mind the fact, so important to our physical development, that the blood circulates much more vigorously, and that we can do twice as much work, when inhaling air of a temperature near zero, as we can when inhaling air near the temperature of the body." This is true when we are taking active exercise, but I apprehend Mr. Leeds has overlooked the important fact that the scholar is for the most part passive,—sitting still, and not taking active exercise. A person may work in a room at 32°, with comfort,

but if he sits still for any time he becomes chilled. We may walk with safety and even with keen enjoyment with the air at zero, but when riding in a cutter at the same temperature we soon suffer unless protected by warm furs, and often have to dismount and run for a distance to restore the animal heat to the extremities.

The plan of warming the floor and walls strikes me as excellent in theory, and I should be very glad to see it practically tested. Two things will stand in the way of its immediate and extensive introduction. 1st, the difficulty of remodeling our present school-houses so as to introduce it; and 2d, the increased expense in introducing his method in new houses. This last objection should not be decisive, if the plan is found to work as well as it promises. I protest against weighing the life and health of our children against dollars and cents. If Mr. Leeds' plan shall effectually replace the present faulty system, and especially the *no system* now in use, the world will have taken an important step in a very desirable direction.

METHODS OF WARMING.

A room may be warmed by an open fire, by steam coils, or radiators, by furnaces, or by stoves. In a small room an open fire is the most cheerful and healthful mode of warming. but it is impracticable in a large room, because the intensity of radiant heat decreases as the square of the distance increases, and hence it is impracticable to heat a large room by this means. Radiation from steam coils placed in the room is probably the worst method of heating, because it does not provide for any renewal of air, and hence ventilation is practically impossible as steam coils are ordinarily used. But when steam coils are placed in a furnace chamber, and the air is heated by flowing over these coils before it enters the room, the method becomes a very good one. Two great objections are the large expense and *the liability to get out of repair.* Another most serious objection is the *possibility of most serious accidents.* When we think of large school buildings filled with children, and of three or four large steam boilers in the basement, and contemplate the possible results to life and limb, of an explosion of these boilers, we are led to earnestly desire some safer method of heating our large school buildings. It is said that in this country, the question whether a steam boiler will explode, is only a question of time. When that time comes for some of the steam boilers in our large schools the people will be aroused to a sense of this danger as by a throb of an earthquake.

A very ingenious and economical method of heating by steam has been devised by H. G. Bulkley, of Cleveland, Ohio, but which I believe has never been introduced into this State. By his plan the steam is generated in a small open pan placed inside of a tight box or chamber; through this chamber pass the pipes to convey the air to be heated. Unlike the ordinary steam pipes the steam is outside the pipes while the air is inside, and is heated as it passes through them. The water, formed by condensing the steam on the air pipes,

drops back into the pan to be again converted into steam, etc. In this way there is no boiler to explode, and no pipes full of condensed water, to freeze and burst. I have never seen the apparatus in use, but the plan looks practical, cheap, and safe, and I hope its merits may be tested in this State.

Furnace heat is probably more used than any one kind of heating, in the better class of our school-houses. A furnace, if rightly constructed, and rightly used is a very good means of heating a school building, because it assists in ventilation, and because all the dirt and litter from the fuel can be confined to the basement. Nearly all the furnaces I have examined the past winter are very objectionable because they are too small, and have too little radiating surface to heat the necessary amount of air, unless they are excessively heated. Thus I found that many of the furnaces during cold weather were kept uniformly *red hot.* It is simply impossible that air heated by passing over such red hot surface should be healthful. It has a burnt odor, is excessively dry, and gives a feeling of tightness and constriction to the head that would lead us to suspect the presence of that most deadly and insidious poison,—carbonic oxide. The object aimed at should be to introduce a large volume of air moderately heated, and not a small quantity of air excessively heated. To this end the furnaces should be of large size, with a large amount of heating surface kept moderately heated, and the access of pure air to the furnace, and its passage thence to the school-room should be abundant.

One most stupid arrangement for admitting the hot air from the furnaces into the school-room I noticed in a few instances, viz.: admitting the hot air by openings in the wall from four to seven feet from the floor. The explanation offered was that the hot air would go to the top of the room in any event, and hence it was just as well to send it part of the way toward the top before admitting it into the room. It is true that the hot air will go to the top of the room, and equally true that it will finally go out doors; but, before doing either of these things, we want it to do certain things while on its way. If the hot air enters the room by registers at the floor level, it aids in breaking up the lake of cold and nearly motionless air at the floor level. So, also, the children often enter the school with their feet very cold; and how shall they warm them, with the hot air register seven feet from the floor?

A large number of the school-rooms in our State are heated by stoves. A stove heats a room both by radiation and by convection, or by causing motion by currents of heated air. In consequence of radiation, the stove often heats the part of the room nearest it to an uncomfortable degree, while other portions of the room may be too cold. I think a stove gives the best results when it heats the school-room by convection alone, a more uniform temperature in all parts of the room being secured. When a stove heats mainly by radiation, it is difficult to introduce sufficient air for ventilation and have it so warmed before being distributed to the room as to avoid draughts of cold air. I observed a very good method of introducing fresh air and warming it at the same time, in

some schools in Detroit. The stove was surrounded by a jacket of galvanized iron, standing a foot from the stove on all sides, and rising above the top of the stove. The air from out doors was introduced by a large flue opening beneath the stove, and passed up around the stove and inside the jacket, and thus became properly warmed before being distributed to the room. By this arrangement, those sitting near the stove were saved the discomfort of the excessive heat from direct radiation, and the room could be supplied with pure air at a proper temperature. I shall speak of this method more fully when I present a plan for warming and ventilating a country school-house.

I have seen a stove, called "the ventilating stove," I believe, which seeks to secure this warming of the air when first introduced. It has some 10 vertical flues on each side of the stove,—about two inches in diameter,—through which the fresh air passes as it enters the room. The objection to this stove is that these flues are entirely inadequate to introduce the amount of fresh air needed in a school-room. Twenty of such flues would introduce the quantity of air required for *six persons*, whereas the stove is used to heat a room for *sixty*. I consider the stove worse than a common stove because it beguiles us into the belief that we have ventilation by means of the stove, and hence will not seek for any other method, while this one is entirely inadequate, as I have shown.

TOO DRY AIR IN SCHOOL-ROOMS.

The air of our school-rooms is almost uniformly too dry. In many cases the out-door air is heated to the requisite temperature and brought into the room without any addition of watery vapor. Many persons forget that the capacity of the air to hold watery vapor increases much faster than the temperature. For example, air at 32°, saturated with watery vapor, if heated to 60° without either loss or gain of watery vapor, would be excessively dry. If we represent the humidity of air saturated at 32° as 100, the same air heated to 60° would have a relative humidity of less than 15; or it would hold less than one-sixth of the water it was capable of holding in the form of vapor at the latter temperature. Lehman has shown that the exhalation of carbonic acid in respiration is very sensibly influenced by the amount of watery vapor present in the inspired air. This may explain why persons are so often afflicted with headache when breathing very dry air, and why relief is so soon experienced when the air is moistened by placing a dish of water to evaporate on the stove. Buckheim has also shown that the depth of the inspiration is decidedly influenced by the presence of watery vapor in the air. The influence of excessively dry air on the naturally moist mucus surfaces, is injurious; the nostrils become dry and irritable, and a tendency to catarrh is established. Most persons have observed the relief obtained by breathing air saturated with moisture ("inhaling steam") when they have taken cold, or "have a sore throat." The influence of too dry air on the eye is also injurious, from the unnatural drying of the normal secretions for moistening the eye.

The air in the school-room should be three-fourths saturated with watery vapor. The best way to test the degree of moisture is to suspend two thermometers side by side, one in the usual condition, the other with the bulb covered with a thin piece of cotton cloth kept constantly moist by dipping a portion of the cotton in a suspended cup of pure water. The difference in temperature between the wet bulb and dry bulb thermometer will indicate the relative dryness of the air. Thus if the dry bulb marks 65° and the wet bulb marks 60° the air is exactly three-fourths saturated, and the difference between the wet and dry bulb thermometer should not exceed 5° in any school-room.

On the whole I may safely say that no good means of heating have yet been presented to the people of our State, and the attention of our ingenious inventors is called to this very important subject, in hopes that some perfect system of warming our school-houses may soon be devised. A *perfect method* will include the uniform heating of all inhabited parts of the room, the avoidance of all draughts, or such movements of the air as shall be perceptible to the occupants of the room; the absence of any change in the air by which its chemical composition or physical properties shall be injuriously altered, and the securing to the air of that amount of moisture which shall make the air soft and balmy like a June morning,—not hot and scorching like the breath of the desert.

VENTILATION.

By ventilation is meant the renewal of air in a confined space so as to preserve that degree of purity which is necessary to preserve the life and health of animated beings. In the rude habitations which are found in a newly settled country the necessity for ventilation is less felt, because the imperfections in construction often furnish all the ventilation needed. I well remember the log houses of the early settlers in this State; the open cracks between the logs and the crannies around doors and windows, through which every wind of heaven found entrance, and the huge fire-place which afforded free escape for any foul air. I remember how we used to revolve like planets before the roaring fire, each one revolving on his own axis, "to let one side thaw before the other froze;" but I also remember the almost uniform good health of those early days, always excepting diseases of malarial origin. A quaint old writer says: "When men lived in houses of reeds they had constitutions of oak; when they live in houses of oak they have constitutions of reed." How often have I known farmers to live in vigorous health through long years of toil, in their log houses; but when wealth had accumulated, and they had built themselves better houses, *i. e.*, those approximately air-tight, they have sickened and died. As people advance in wealth, and are thus able to leave their ill-constructed, but well ventilated houses, and to live in those which by superior construction are more or less air-tight, the necessity of providing some adequate means of ventilation becomes more imperative. Because our fathers paid no

especial attention to ventilation and yet were healthy, is no reason why we need pay no attention to it in the altered conditions of our habitations.

WHY VENTILATION IS NECESSARY.

Ventilation is necessary because, so far as respiration is concerned, man must be classed as a poisonous animal. "We poison each other, even in health, —much more in disease." "Man's own breath is his greatest enemy." Air once breathed is unfitted to sustain life. A person breathes about 350 cubic feet of air in 24 hours; but the withdrawal of 350 cubic feet of air from the room would not preserve the air in a pure condition, because the expired air at once mingles with the pure air of the room, which thus becomes more and more foul from this cause. There are no means of withdrawing this expired air alone, and leaving the good air behind. We have no power to "separate the precious from the vile," but precious and vile together must be swept away by an influx of pure air. *Ventilation, at the best, is only a process of diluting a confined foul air by renewal with pure air.* When this is done without injurious derangement of temperature or production of local draughts we have good ventilation.

The expired air is rendered unfit for respiration by three causes: 1st, it is deprived of a portion of its free oxygen; 2d, it contains an excess of carbonic acid,—100 times as much as the inspired air,—and 3d, it contains an animal vapor, or a volatile organic substance, which imparts a peculiar offensive odor to an ill-ventilated and crowded room. In examining the condition of the air contaminated by respiration, we fix our attention upon the carbonic acid, not because it is the only injurious substance present, but because it is easily estimated, and because it is a fair measure of the degree of contamination by respiration.

The consequences of breathing air in an ill-ventilated room are sometimes sudden and striking. One well known instance is that of the 146 Englishmen confined by Surajah Dowlah, in "the black-hole," in Calcutta, a room 18 feet square, with a few small windows. Before morning 123 were dead, and of the remaining 23, the most died in a few weeks of a putrid fever. But it is only in extreme cases that these consequences show themselves so rapidly. In less violent cases the effects show themselves more gradually. There is a slow undermining of the health; the person is low-spirited; his cheeks are pale and dusky, or flushed with fever; headache is frequent, and after a time, typhoid fever or consumption comes on, and these are then supposed to explain the previous ill-health, while they may be only the product of this slow poisoning. Rev. Daniel Leach, Superintendent of Schools in Providence, R. I., writes: "I was rejoiced to hear that the Michigan State Medical Society had taken up the subject of ventilating and warming school-houses. There is no subject connected with the cause of education so important, and none that has been so neglected. I have given attention to the subject for more than twenty years,

and I firmly believe, from careful observation, that very many cases of consumption, heart disease, and kindred diseases, have had their origin in the foul air that is breathed in school-rooms and other crowded places." Dr. McCormac, of London, has published a work: "Consumption and the Air Rebreathed," in which he holds the theory that Consumption, as well as tubercle generally, is always and exclusively the result of breathing air that has already been vitiated by respiration. "The Doctor, doubtless, makes too much of this theory, but, quite as certainly, people generally make too little of it." I might fill pages with quotations from medical authorities to show how intimate is the relation between tubercular diseases and foul air. But these diseases of degraded tissues are only one class in a score of diseases caused by breathing foul air.

The limit of impurity in air as affected by respiration, should not exceed the the presence of 8 parts of carbonic acid in 10,000 of air. Many place the limit lower than 8 parts,—it certainly should never be higher. Persons may, and do, live in an atmosphere less pure, but it is at the expense of present and future vitality. Sickness must be viewed, not solely as involving the suffering and danger of the patient, but also as a loss to the State. This consideration bears with especial force upon the sanitary condition of the young, because they are peculiarly liable to the action of depressing causes. The State is rich and strong in its healthy men and women, and is impoverished by its weak and sickly ones. In laying our hands upon the sanitary conditions of our public schools, we touch the very fountains of the prosperity of the commonwealth.

RESULTS OF INSPECTION OF SCHOOL-HOUSES.

In order to obtain satisfactory information in regard to the condition of ventilation in the school-houses of this State, I visited some 30 schools, examining the principal rooms, their mode of warming and ventilating, the degree of impurity in the air of the school-rooms, their condition in regard to temperature, dryness, etc. I visited some of the leading schools, and others of lower grade, so as to make the results somewhat representative of the schools as a whole. The results, of course, would have been more satisfactory if they had included a much larger number of schools, but with the limited time at my disposal I found this impossible. I present the results in a tabulated form.

Place.	SCHOOL.	Carbonic acid in 10,000 parts of air.	Dry bulb Thermometer at desk level.	Wet bulb Thermometer at desk level.	Thermometer at floor level.	Means of Ventilation.	REMARKS.
Lansing.	High School	37.5	64°	57°	58°	Doors and windows, and small tube	Room supplied with fresh air by sheet-iron tube two inches in diameter, passing from external air into lower part of stove-pipe, passing up through the stove-pipe into the room. This pipe was supposed to supply fresh air for fifty scholars. No exit for foul air. Headache almost universal.
	Library Block	31.6	67°	57°	61°	Doors and windows, and two small vent. shafts	Only ventilation by two small shafts, through which the air passed out of the room or into it, according to direction of wind. Air smelled very foul, notwithstanding that the doors and windows were kept open as much as possible.
	Fifth Ward—North Room	32.	66°	56°	47°	None	Headaches, catarrhs, cold feet. A difference of 19° between level of desk and of floor readily explains all this misery. Smoke in the room.
Okemos.	High School	29.04	67°	58°	59°	None	No ventilation, because school officers neglected to make any opening into the ventilating shafts which pass through the room. Great complaint of headache and lassitude after being a short time in the school-room.
	Primary	21.47	66°	58°	61°	Two shafts, with small opening near floor	Much less complaint of headache and cold feet than in the room above. The openings into ventilating shafts too small, and hence imperfect ventilation.
Ypsilanti.	Normal. Chapel of Normal	17.2	70°	60°	65°	Shafts without central heat; too small	Air gathered after room had been used one hour. Ventilation defective because foul air shafts are too small, and openings into the shafts too small. A great improvement over the old system of no ventilation. Headaches less frequent since its introduction.
	Normal. Laboratory of Normal	25.82	65°	60°	58°	None	Air very close and disagreeable. Air gathered after room had been used only one-half hour.
	Normal. Prof. Putnam's room	23.26	----	----	----	Vent. shafts too small	Ventilation defective from too small shafts, too small registers, and no central heat in shaft.
Ypsilanti.	Village School. High School of Village	26.15	----	----	----	Small flues in wall, opening near ceiling	Defective ventilation, by means of small shafts placed in the wall. But little movement of air could be detected in these shafts. Air smelled foul, even with doors and windows open.
	Village School. Village School	27.70	----	----	----	Small flues in wall, opening near ceiling	
Ann Arbor.	High School	29.04	67°	59°	62°	Shafts that do not ventilate	Heated by steam coils—direct radiation. No means of introducing fresh air. Ventilating shafts, but no ventilation, as the wire screens over the registers were entirely obstructed by lint and dust. Air had a foul smell: great complaint of headache.

Jackson.	High School	30.85	72°	58°	57°	Small air shafts in wall with small openings near ceiling	Room unequally warmed; 15° difference between head and heels. With hot head, cold feet, and foul air to breathe, headache is considered a proper thing to have in this school.
	Prof. Gass' School	31.75	68°	55°	42°	Ruttan's	Difference of 21° in temperature between head and heels. Hot air enters by flue in wall five feet from the floor.
Battle Creek.	Primary	17.31	55°	47°	57°	Ruttan, modified	Janitor said it was often difficult to get the air to pass up through the ventilating shafts; that he generally kept the bottom of the shaft in the cellar open to secure draught. The reason for this difficulty is that all the foul air shafts in the building terminate in a tight garret. The only possible escape of the foul air was through a small window, accidentally left open.
	First Intermediate	28.75	----	----	----	Ruttan, modified	
	"A" Grammar	10.88	62°	56°	63°	Ruttan, modified	
	Past Intermediate	8.66	69°	59°	68°	Ruttan, modified	
	High School	8.44	67°	58°	62°	Ruttan, modified	
North Lansing.	Lower Room	30.	66°	59°	52°	None	No ventilation except by opening doors and windows. Headache and catarrhal troubles very common.
	Upper Room	27.50	67°	58°	60°	None	No ventilation except by opening doors and windows. Row of desks next the wall on two sides. A thermometer in one of these desks marked 7° below temperature of body of room.
Delhi.	Village School	31.4	67°	57°	54°	None	No ventilation except by cracks in walls or opening windows.
Detroit.	Cass Union	18.87	65°	55°	62°	None	"Teachers are told to be careful to secure good ventilation by opening windows, etc."
	Cass Union	13.4	66°	57°	60°	None	Windows open when air for analysis was gathered.
	Houghton	30.15	68°	59°	62°	None	Windows open when air was gathered. Fresh air is brought in by pipes opening on inside of metallic jacket enclosing stove. No exit for foul air. Great complaint of headache.
Kalamazoo.	Frank Street. Primary	14.6	66°	65°	65°	Shafts 12x12 inches, without internal heat; openings at floor and near ceiling	Observations taken on warm winter day; windows and doors open part of the time.
	Frank Street. Intermediate, "A"	7.28	71°	63°	70°	Shafts 12x12 inches, without internal heat; openings at floor and near ceiling	Windows open at time of observation.

Place.	SCHOOL.	Carbonic acid in 10,000 parts of air.	Dry bulb Thermometer at desk level.	Wet bulb Thermometer at desk level.	Thermometer at floor level.	Means of Ventilation.	REMARKS.
Kalamazoo.	Union. Primary	9.06	73°	63°	77°	Shafts 12x18 inches, without internal heat; opening at the floor and near ceiling	Room over furnace room, and hence the high temperature at floor level.
	Union. Grammar "B"	27.37	71°	63°	68°	Shafts 12x18 inches, without internal heat; opening at the floor and near ceiling	Air gathered at recess, while the scholars stood in a dense throng around me to witness the operation, and hence the large quantity of carbonic acid.
	Lovell Street. First Primary	31.7	65°	58°	61°	None	Heated by furnace, with no escape for foul air, except by opening a window; great complaint of headache.
	Lovell Street. Third Primary	23.26	68°	62°	65°	None	The janitor says: "It is very difficult to warm these rooms, especially if the wind blows, and impossible to ventilate." The only wonder is that they can be warmed at all.
Dowagiac.	High School	17.93	64°	58°	63°	Shafts 8x12, without central heat; openings near floor and ceiling	Heated by furnace which is often red hot. Windows partially open at all times.
	First Intermediate	18.38	69°	61°	61°	Shafts 8x12, without central heat; openings near floor and ceiling	Heated by furnace which is often red hot. Windows partially open at all times.
	Ward School	22.	64°	55°	59°	None	Air taken from bottom of the room by flue to furnace, where it is heated and again returned to the top of room. Economy with a vengeance. No supply of fresh air possible, except by opening doors or windows. Windows open at time of observation.
Paw Paw.	High School	20.15	64°	58°	60°	Ruttan; shaft with central heat; shaft 5x5 feet.	Air shaft large and central heat gives good draught, but the imperfect arrangement of educt shafts, by which the air is carried to cellar before it can enter ventilating shaft, and the small size of educt pipes and the openings into the same, give poor ventilation. Hot air from furnace enters room by opening in the wall, seven feet from the floor. Room warmed very slowly in the morning.
	Grammar School	21.	67°	61°	64°	Ruttan; shaft with central heat; shaft 5x5 feet.	
Saginaw City.	Secondary	12.65	69°	66°	68°	Ruttan; door and windows partially open	Heated by furnace on Ruttan plan; foul-air exit flues in platform at floor level. Flues too small; formerly great complaint of headache; less since the present system has been introduced.
	Third German	19.31	71°	66°	69°	Ruttan; windows partially open	
	High School	24.64	69°	64°	67°	Ruttan; windows and door closed	
	Grammar	14.	71°	66°	71°	Ruttan; windows and door open	

East Saginaw.	Primary (basement)	30.	65°	57°	60°	None	Air very close and offensive.
	Grammar	29.5	66°	60°	68°	None	Air close and disagreeable; headache.
	High School	15.42	67°	61°	67°	None	Small number of scholars in proportion to size of room at time of observation.
	Hoyt Branch	17.8	----	----	----	Ruttan	Not so well ventilated as other rooms in same building on account of direction of wind.
Howell.	Grammar	43.29	69°	63°	61°	Shafts in wall without internal heat	Lawson furnace heated *red hot*. Ventilating shafts 10x18 inches; hot air registers in wall near floor, and foul air exits in base-board. The specimens of air gathered within one hour after school opened. "Very difficult to ventilate when wind blows in certain quarters. Often the air blows down the shaft into the room."
	Intermediate "A"	21.	67°	58°	60°	Shafts in wall without internal heat	
	Primary "A"	25.	66°	57°	60°	Shafts in wall without internal heat	

Place.	SCHOOLS.	Carbonic acid in 10,000 parts of air.	Means of Ventilation.	REMARKS.
Reform School.	No. 1	30.63	None	Heated by steam coils, with direct radiation. No provision for introducing fresh air, and no ventilation except by opening windows. During a portion of the year this is an evening school, and lighted by kerosene lamps. Reform School needs reformation.
	No. 2	27.52	None	
	No. 5	31.	None	
State Capitol.	House of Representatives	23.2	Ruttan; defective foul air shafts	A great deal of sickness among members of House during every session of Legislature. Air gathered March 5, 3 P. M.
	Senate Chamber	17.	Ruttan; defective foul air shafts	Air gathered March 11, at 4 P. M., during the discussion on the "Park Bill."
Agricult'l College.	Lecture Room of Laboratory	9.	Shaft 16x16 inches	Air gathered after room had been used for classes for two hours.

METHODS OF VENTILATION.

The two principal methods of ventilation are mechanical ventilation, and thermo-ventilation, or natural ventilation. By mechanical ventilation a room may be ventilated by forcing air into it by a huge pump, or revolving fan, when the air in the room will tend to overflow by any openings in the walls of the room. This is called the *plenum* method. By arranging the pump or fan so as to draw the air out of the room, the deficiency of air in the room being supplied by air entering the room by any openings, we have the *vacuum* method. Many kinds of apparatus have been devised for this mechanical ventilation, and very perfect ventilation has been secured in this way. But mechanical ventilation is not adapted to the use of schools because of its great expense.

Thermo-ventilation is called natural ventilation because it is the method by which we see motion imparted to air in nature, and is the method almost exclusively employed in schools; though we sometimes aim to increase this by the mechanical action of wind by placing a cowl or louvre on the top of the ventilating shaft.

The cause of motion of the air in natural ventilation is heat, which acts by producing a difference in the weight of a given volume of air, the specific gravity of air diminishing with an increase of temperature, when not confined. A body of air when heated will expand, unless confined, and will thus become lighter than an equal bulk of colder air, and will tend to rise above colder and heavier surrounding air. A cubic foot of dry air at 32° will weigh 567 grains; but a cubic foot of air at 200° will weigh 385 grains (fractions omitted). A column of air one foot square and 20 feet long, at 32°, will weigh 11,340 grains; while a similar column of air at 200° will weigh only 6,704 grains; and by this difference in weight, viz., 4,636 grains, will the colder column underflow the warmer column if they are joined at their base. If we preserve permanently in the warm column this difference of temperature, so that the cold air, as it enters, itself becomes warm, there will be a permanent flow of air up this heated column; and the greater the difference in temperature between the air in this column and that of surrounding air, the stronger will be this ascending current. For similar reasons, the longer is this column of heated air, the stronger will be the ascensional force. The draught or motive power therefore will be proportional to the length of the shaft, and the difference in temperature within the shaft over that of the surrounding air. If the temperature in the shaft is the same as that of the surrounding air, there will be no motion, however long the shaft; if the temperature is less in the shaft, there will be a downward current in the shaft, or reversed ventilation. To secure the most powerful ventilation, therefore, we should have the shaft as long as convenient, and the air inside it should be kept as warm as possible. For economy of fuel, the ventilating shaft should not be placed in the outside wall of the building, but in the center of the building; and

for the same reason the smoke-pipe of the stove or furnace should pass up inside the shaft, so as to use the waste heat of the fire in ventilating the building. The shorter the ventilating shaft, the less will be its motive power even with the same temperature in the shaft. Where several floors are to be ventilated, the upper floors will have less motive force for ventilation, because of this diminished length of shaft. This difference may be compensated by making the openings into the shaft larger for the upper floors than for the lower.

When I speak of the length of the ventilating shaft I mean the vertical distance from the room to the top of the shaft. At first thought it might seem that by carrying the air from a room into the basement and letting it enter the ventilating shaft at that point, we would secure a greater length of shaft and hence increased ventilation, but such is not the case. The friction of air against the sides of the shaft, is a loss which becomes an important factor in the problem of ventilation, when the air has to move through a long and angular shaft. In the Ruttan system, as applied in many schools in this State, the air is carried from all the rooms by foul-air ducts into a common reservoir in the basement, and from this reservoir it passes directly into the ventilating shaft. By reason of friction there is a large loss of motive power, in carrying the air from the upper story into the basement and then carrying it back to the same level on its way to its final escape, and no corresponding gain of power by the apparent increased length of shaft. But there is a greater objection still, viz.: that the air will not be uniformly and equally drawn from all the rooms. The ventilating shaft will draw the air from this common reservoir, and air will be supplied to the reservoir in great part from those rooms from which it can enter the reservoir with least resistance. From some rooms the air may be withdrawn too rapidly, and from others, perhaps not at all. If there is a strong wind it will often control, and even reverse the ventilation of some of the rooms, so that a room is often ventilated (?) by forcing the foul air from another room into it. The reasons assigned for this basement ventilation are that if the foul-air ducts on the different floors open directly into the ventilating shaft, the draft will vary for each floor level, in consequence of the variation in the length of the shaft, and that regurgitation of foul air into some of the rooms will be of frequent occurrence. I have pointed out how the first difficulty may be obviated, and will point out the means of removing the second before I close.

FROM WHAT PART OF THE ROOM SHOULD THE AIR BE WITHDRAWN IN VENTILATING?

There has been much discussion on this question. The expired air is unfit for respiration from deficiency of oxygen, excess of carbonic acid, and the presence of a peculiar animal vapor which imparts the repulsive odor characteristic of a crowded and ill-ventilated room. But little is known in regard to this animal vapor. No one has determined its exact chemical composition or

its specific gravity. Dr. Odling believes it to be carbo-ammoniacal. Dr. Angus Smith has shown that expired air contains ammonia, but whether this animal vapor is a salt of ammonia combined with some volatile organic acid has not been determined. At elevated temperatures it is much more offensive than at low temperatures, and hence it would seem to be in excess in the warmer parts of the room, but this does not necessarily follow. An Esquimaux hut with its walls of snow will not be as offensive as a warm school-room with the same amount of contamination from respiration and other causes, the amount of ventilation being equal in both cases. The snowy surface would condense upon itself much of this animal vapor, and thus remove it from an active condition. This vapor seems to be easily condensed by cold and moisture, which may explain the fact that the condensed moisture of the breath easily putrifies. That it is very injurious to animal life is shown by the fact that air loaded with this vapor, though deprived of its excess of carbonic acid, and the deficient oxygen supplied, is still destructive to animal life. It is unquestionably very important to remove it by ventilation, but till we know more about it, and have some reliable means of estimating its quantity in the air, we cannot determine from what part of the room the air should be withdrawn to most effectually remove this substance by ventilation.

In the present state of our knowledge the factors with which we have to deal in this problem are the composition of pure air, of expired air as regards oxygen, carbonic acid, and watery vapor (the nitrogen remaining nearly unchanged in quantity), the influence of temperature on the density of these gases, and the action of the law of diffusion of gases. Expired air differs from normal air by a deficiency of oxygen, and an excess of carbonic acid and watery vapor. The most marked change is the large increase of carbonic acid, the expired air containing about 100 times as much carbonic acid as normal air. This gas is much heavier than air, having a specific gravity of 1.529,—air being 1.00. From this fact some argue that the carbonic acid will fall to the bottom of the room and accumulate there, while the lighter oxygen and nitrogen will rise to the top, and hence conclude that the ventilation should be from the floor level to draw off the excess of this poisonous gas. The experiment of pouring carbonic acid from one vessel into another and thus extinguishing a burning candle in the second vessel, would seem to demonstrate the correctness of this view. But if this vessel full of carbonic acid be left uncovered and undisturbed for an hour or two, the carbonic acid will have disappeared so completely that a lighted candle will again burn brightly in the vessel. The density of a gas does not determine its permanent position.

Others claim that the expired air will be lighter in consequence of its increased temperature and increased amount of watery vapor which is much lighter than air, and hence the expired air will rise to the top of the room, and ventilation should be entirely from the top. When we breathe the air on some cold morning in winter, the condensed moisture of the breath enables

us to trace its course for a time, and we see it rise. The colder the external air, and consequently the greater the difference between its temperature and that of our breath, the greater is this tendency of the breath to rise. Whenever the breath is warmer than the external air, it will be lighter than such air and *as long as it maintains this excess of temperature it will tend to rise.* The expired air will be lighter than air at the usual temperature of a living-room, *e. g.* 65°. Thus a cubic foot of air saturated with moisture at 98°, with the barometer at 30 inches, will weigh 484 grains, while the same quantity of air in like circumstances at 65° will weigh 523 grains (fractions omitted),—a difference of 39 grains to each cubic foot; and the warmer air will tend to ascend in consequence of this difference in weight. But the expired air has not only received an increase of watery vapor (there is dispute whether the breath is saturated, but in this discussion I assume it to be saturated), and temperature, becoming lighter from both causes, but it has received an increase of a very heavy gas—carbonic acid. The increase of weight from carbonic acid would diminish the difference in weight of a cubic foot of air at 98° over air at 65° to about 31 grains. An ordinary expiration contains about 20 cubic inches of air. The air of each expiration would therefore be about $\frac{1}{2}$ of a grain lighter than air at 65°. The air as it leaves the nostrils receives a downward impulse which will tend to neutralize its tendency to ascend in consequence of being lighter. But there are two causes which prevent the full action of this increased lightness of expired air. 1st, by mingling with the air of the room it speedily acquires the same temperature, the quantity thrown out at each expiration being so small that this intermingling with other air and consequent cooling is rapidly effected; 2d, the diffusion of gases tends to maintain a constant composition of the air in all parts of the room. As a consequence of the action of these forces it is found that the actual composition of air at the floor level and at the ceiling, does not materially differ, for it has been found that the air taken from the gallery, and from the pit of a crowded theatre did not exhibit any material variation in chemical composition. So far then as the composition of the air is concerned, it is a matter of indifference whether it is taken from the top or bottom of a room.

But in actual practice it is a matter of great importance whether the air is withdrawn at the floor or the ceiling. Cold air is heavy and sinks to the floor; while hot air rises to the top, unless prevented by skillful ventilation. This condition always exists in rooms warmed by ordinary means during cold weather; a lake of cold air at the feet, and hot air around the head. In the room in which I am now writing, warmed by a large stove, and with no outside doors, I find the temperature at the floor 60°, 3 feet from the floor 74°, and 10 feet from the floor 79°. Here is a difference of 14° between the temperature at my feet and at the level of my chest, as I sit at my table. If the air were withdrawn from this room 10 feet from the floor, instead of the floor level,

there would be the loss of 19° in the air withdrawn, and there would be no tendency to draw off the lake of cold air at my feet.

I consider it very desirable to ventilate from the floor level; *not because the air is fouler at that level than at the ceiling, but because, being equally foul, it is colder than air near the ceiling, and therefore less fitted for the comfort and health of the occupants of the room; and also because the strong tendency to accumulate a lake of cold air at the floor can usually be obviated in no other way.*

It is not a matter of indifference whence the air is withdrawn at the floor level. In many school-rooms the air is withdrawn beneath the teacher's platform, or at the sides of the room. It should be withdrawn at many points in the body of the room, by openings into foul-air ducts beneath the floor. The law of diffusion, by which every gas acts as a vacuum to every other gas, is a scientific truth, but it acts slowly with heavy gases, the rapidity of diffusion being inversely as the square root of the density of the gas. The accidental experiment which I performed in a school in Kalamazoo, of gathering the air for analysis during recess, while the scholars stood around me in a dense throng to witness the operation, this air containing a large excess of carbonic acid, shows the necessity of withdrawing the air from those portions of the room where the scholars most congregate. If the spaces between the floor joists are all made foul-air ducts, it would be a matter of very small expense to ventilate from as many points in the room as we desire.

QUANTITY OF VENTILATION.

To preserve the air of a room in such state of purity that the carbonic acid shall never exceed 8 parts in 10,000 of air, 2,000 cubic feet of air must be admitted every hour for each person in the room. In a room 30x30x12, and containing 36 persons, 72,000 cubic feet of air an hour must be introduced, and the entire air of the room changed six times an hour. If we allow ten square inches of sectional area in ventilating shaft for each person, this number of scholars would require a ventilating shaft 19x19 inches; the air must move through it at the rate of 5½ miles an hour; if the shaft is 20 feet long, it will require a permanent elevation of temperature 15° above outside air.

HOW TO VENTILATE.

The ventilation of a school-room is so intimately associated with the warming of the same, that the two cannot satisfactorily be considered separately. "Warmth must be obtained as the first demand of nature, and without it civilization will go back. When men are cold they give themselves to physical exercise; and if that is impossible, to discomfort, in which the mind refuses to do more than to complain if it cannot forget."* A poorly warmed school-room defeats the very object for which a school exists, by preventing all mental activity except grumbling, which needs no special culture.

*Air and Rain, by Dr. R. Angus Smith.

In my estimation, no ventilation is good which requires the opening of doors and windows at any time. Window ventilation is better than no ventilation, but it is not good ventilation. It is often used in warm weather, but I consider it undesirable, because it admits insects, dust and hot air, *i. e.*, air hotter than might be secured by properly arranged air-ducts, which may be so contrived as to introduce comparatively cool air. But window ventilation certainly should never be used in cold weather, while the scholars are not taking active exercise. It is never necessary with good ventilation.

Ventilation should, as far as possible, be automatic, and should be beyond the control of every one except the person who has it in charge. This self-acting ventilation may best be secured by combining the ventilating system with the warming apparatus, so that the active condition of the warming apparatus shall necessitate an active ventilation; because we are much more sensitive to a change of temperature than we are to the stupefying influence of foul air.

The construction of school-houses in this State is very faulty, because in the original plan little or no attention was given to ventilation, whereas it is one of the first subjects which should receive consideration. In the original plan it is very easy to provide for ventilation; but when once the building is erected, it is very difficult to introduce good ventilation without greatly disfiguring the building. The air-ducts should be abundant, but should be kept out of sight. The most natural and economical position for the foul-air ducts is the space beneath the floor, between the joists. These can all be connected with the ventilating shaft by having the joists all lead toward the shaft, and the spaces all connected with the shaft. But the joists often cut at right angles the line leading through the center of the room to the ventilating shaft, or a beam, which is the principal support of the center of the floor, prevents all communication with the shaft. These and other considerations show how important it is to provide for the ventilation in the original plan of the building, and not to introduce it as an afterthought.

The ventilating shaft should be well constructed so as to be air-tight, if possible. As ordinarily constructed they are very porous, so that a large portion of the air discharged at their top, is not derived from the rooms to be ventilated, so that a brisk current may be found issuing from the top of the shaft, while no corresponding current enters at the bottom. To make the shaft as air-tight as possible, and also to obviate friction of air against the sides, the inside should be smoothly plastered throughout the whole length. Care should also be exercised that mortar dropped by the mason in constructing the shaft does not more or less completely close up the shaft and prevent all ventilation. The shaft should also be placed entirely within the building,—in its center, if practicable. This interior position should be given it, in order to secure so high a temperature in the shaft as to insure motive power enough for ample ventilation by the waste heat of the stove or furnace. It should be of

sufficient size, but not too large. If too large there is danger of return currents of cold air by the side of the shaft. To estimate the size of the shaft, I have taken the estimate adopted for ventilation in the barracks of the British Army, viz.: ten square inches of sectional space in the shaft for each person. Dr. Parkes takes 24 square inches; but this I apprehend is for shafts without central heat. In the center of the shaft I would place the pipe to convey away the smoke from the furnace, and thus utilize the waste heat to warm the shaft. In order that each room may receive its own share of ventilation, and to prevent the foul air of one room from being driven into another room, when high winds prevail, I would divide the shaft-space outside the smoke-pipe into two or four shafts, by having two or four sheet iron plates passing from the whole length of the smoke-pipe radially, till they strike the sides of the shaft. These long vertical plates can be riveted to the sides of the smoke-pipe, and at their outer edge they can be imbedded in the brick work of the shaft, and thus secure two or four shafts equal in size, and each exposed to the same amount of heating surface in the smoke-pipe. If properly constructed, these air spaces will not communicate with each other, but be perfectly distinct shafts throughout. It will therefore be impossible for one of these shafts to rob or interfere with the action of another. One of these shafts may be devoted to ventilating one room or floor, and the others may perform a like office for others. Into these ventilating compartments of the main shaft, the foul-air ducts enter directly from the floor level of the room to be ventilated.

The smoke-pipe should be of large size (12 to 16 inches in diameter), to insure the perfect removal of smoke and all products of combustion, and also to afford heating surface to warm the air in the shaft. By a little skill in arrangement it will be easy to heat this central pipe by a small stove in the basement in summer, and thus secure good ventilation in the hottest weather in summer, without warming the rooms in the least. The inlet ducts to admit fresh air, whether hot or cold, should have the same sectional area as the educt pipes for foul air, viz.: ten square inches for each person. The practice is altogether too common of making the registers for admitting warm air much smaller than I have indicated, and of admitting the air at a very high temperature *i. e.*, a small amount of very hot air, instead of a large amount of warm air. The air should never be admitted at a temperature much above 145 degrees. These red-hot furnaces are an abomination which should never be tolerated in a civilized community.

I have treated these subjects at some length because I consider the proper, warming and ventilation of our school-rooms as prime necessities for the success of our common school system. A proper temperature as the first condition of mental activity, and the removal of carbonic acid, which "lowers the vitality and kills with indefinite warning," are essential conditions for the development of a nation that is yet to rule the world. We have abolished

the choking of our worst criminals by the hangman's rope; let us abolish the strangling of the innocent children by viewless ropes of poisoned air.

METHOD OF ANALYZING AIR.

Perhaps it may not be out of place to say a few words concerning the method employed in analyzing air, so that, if others should take up and extend these observations, their results may be easier of comparison from employing the same method.

The method I employed is a modification of Pettenkofer's. A definite quantity of the air to be analyzed, at the temperature of 65°, and barometric pressure of 28.88 inches (the average pressure in this State), is gathered in some glass vessel. The bottle I used contained 2,500 cubic centimetres. Baryta-water or lime-water in definite quantity and of known strength, was added to combine with the carbonic acid of the air, to form carbonate of baryta or lime. Baryta-water and lime-water are alkaline in their reaction, while the carbonate is neutral. A standard solution of oxalic acid is prepared, of such strength that one measure of the solution shall have the same neutralizing power as the same measure of carbonic acid would have, at the given temperature and pressure. If we take the weight of 1,000 cubic centimetres of carbonic acid at 65°, bar. 28.88, as 1.7612 grammes, then a solution of 5.0435 grammes of pure crystalized oxalic acid, in 1,000 cubic centimetres of pure water, would equal in saturating power, measure for measure, the carbonic acid of the given density. This I call my normal oxalic solution. My method differs from Pettenkofer's in making this normal solution equal to a corresponding measure of carbonic acid, instead of a certain weight.

Twenty-five hundred parts of pure air will contain one part of carbonic acid, or 4 volumes in 10,000. If I add a definite measure of baryta-water to 2,500 cubic centimetres of such air, the one volume or cubic centimetre of carbonic acid will combine with the baryta, and it will then require one cubic centimetre less of my normal solution to neutralize the alkaline condition of the remaining baryta than it would before the carbonic acid of the air had combined with it.

In analyzing the same quantity of air of unknown composition, every cubic centimetre of the normal solution less than the previously ascertained quantity necessary to neutralize my measure of baryta-water, will represent one volume of carbonic acid in 2,500 of air, or 4 in 10,000. For example, suppose my bottle has the capacity of 2,520 cubic centimetres. I fill the bottle with the air to be analyzed at temp. of 65°. I pour into the bottle exactly 20 cubic centimetres of baryta-water. This will expel 20 c. c. of air, and leave 2,500 in the bottle. The bottle is agitated very thoroughly to cause the baryta to combine with the carbonic acid, and the whole is allowed to stand 6 hours to insure complete combination. Suppose the 20 c. c. of baryta-water required 11.25 c. c. of normal acid solution to neutralize it; but the liquid remaining in the bottle of air

requires only 8.1 c. c. The difference, viz.: 3.15 c. c., represents the same volume of carbonic acid in 2,500 of air, or there were present in 10,000 parts of such air 12.6 parts of carbonic acid.

The point of neutralization is ascertained by turmeric paper.

POPULAR TEST OF PURITY OF AIR.

It is often desirable to test air to see if it is of a required purity. To test whether air does not contain more than 8 parts of carbonic acid in 10,000 of air, fill an 8 ounce vial with pure water (rain water), empty out the water in the air you wish to test; the vial will thus be filled with the air of the room. Pour into the vial half an ounce of clear lime-water, and shake thoroughly. If it remains perfectly transparent, without any trace of milkiness or turbidity, it does not contain more than 8 parts of carbonic acid in 10,000.

This test is taken from Dr. R. Angus Smith's work, "Air and Rain."

PLANS FOR A VENTILATED SCHOOL-HOUSE.

I present a ground plan and vertical section for a country school-house capable of seating 126 scholars. The plan is for a two-story house, warmed by a stove. The plan is altered from one presented by A. C. Martin, architect, in the Massachusetts Report of State Board of Health for 1871.

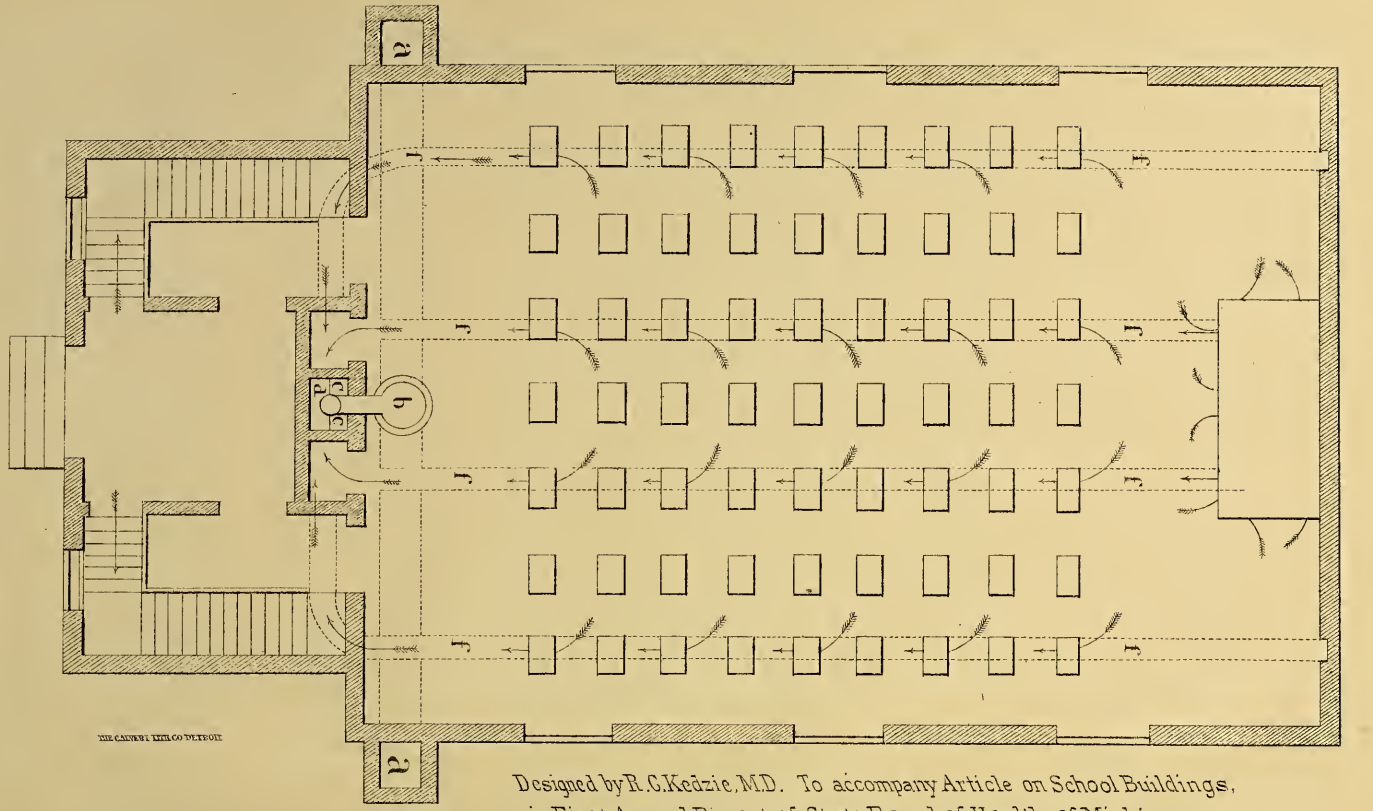
The air to supply the lower room enters by the air pipe marked *a*, passing beneath the floor and opening under the stove, *b*, around which is a galvanized iron jacket entirely surrounding the stove (recessed for the stove door) and rising up as high as the top of the stove. The space between this jacket and the stove is one foot on all sides. The cold air as it enters is thus warmed by the stove before reaching the inhabited part of the room. The scholars sitting near the stove are screened from the excessive heat of the stove by this jacket.

The foul air is drawn off by the foul-air ducts, *f. f. f. f.*, these ducts being formed by the spaces between the joists which run lengthwise with the body of the house, while the joists in the vestibule run at right angles to these. The direction of the foul air is indicated by the arrows at the floor level. The foul-air flues all terminate in the front half of the ventilating shaft, *d*.

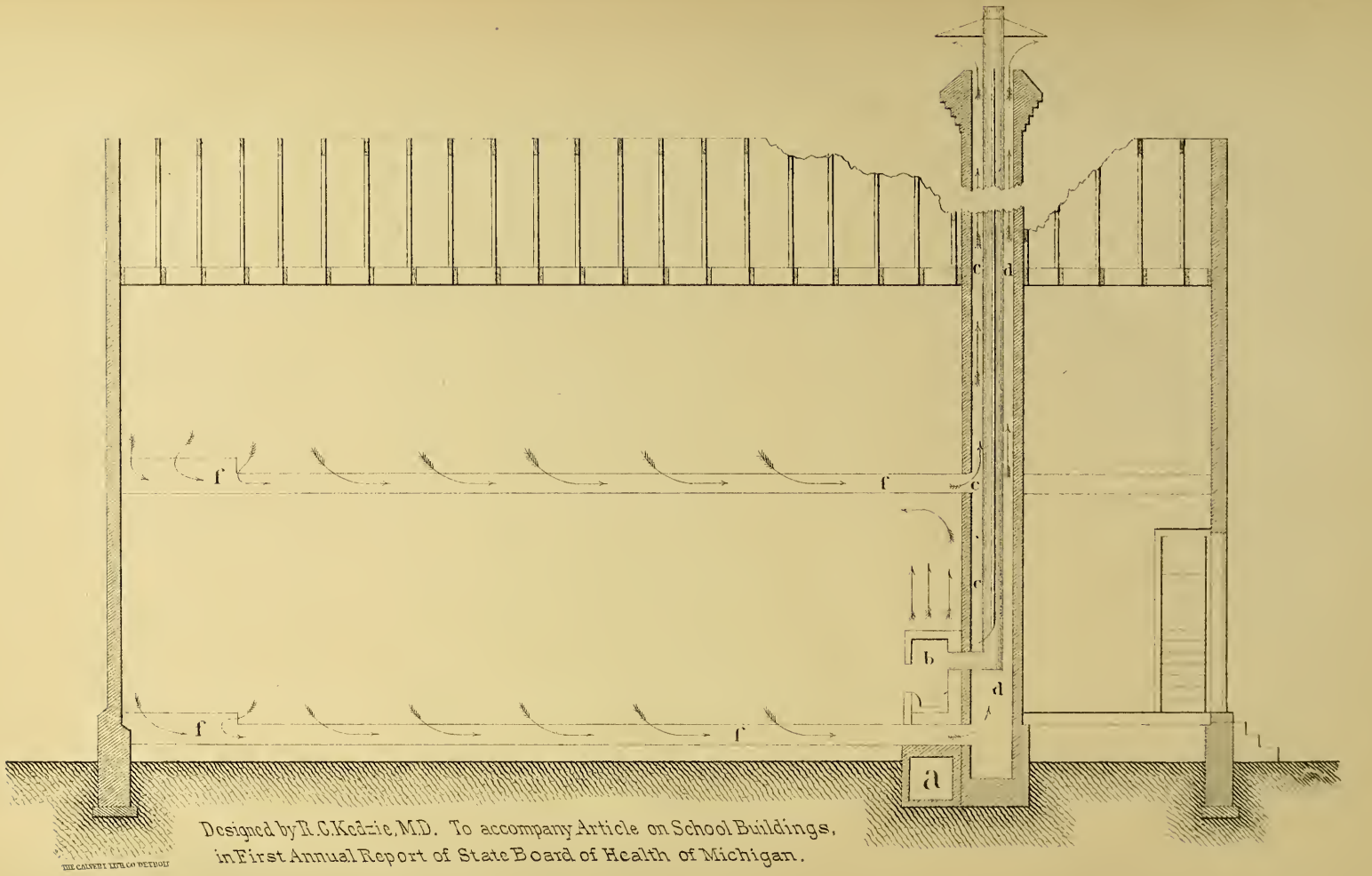
The straight arrows in the vestibule show the direction of ascent up the stairs.

In the vertical section, plate second, the letters have the same uses as in the ground plan. As it is essential that the ventilating shaft should be carried up some distance above the ridge of the roof, and as there is not room on the page to carry up the shaft to the required height, and to represent the cowl on the top, the roof is cut away in the plate, and a break in the shaft indicates the incomplete extension of the shaft.

The position of the stove in the upper room is not indicated, but it has the same position, and is supplied with air in the same manner as the stove in the lower room.



Designed by R. C. Kedzie, M.D. To accompany Article on School Buildings, in First Annual Report of State Board of Health of Michigan.



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THE CALVERT LITH. CO. DETROIT

The foul air of the upper room is drawn off by foul-air ducts exactly corresponding with those in the lower room, except that they all enter the compartment *c.* in the ventilating shaft. For successful ventilation I consider it essential that the foul air of each room shall enter a separate compartment in the ventilating shaft, and not one common shaft. These separate compartments are secured by having vertical iron plates passing from the smoke-pipe to the interior surface of the shaft where they are imbedded in the brick work. In this way two or more ventilating shafts may be made, with the smoke-pipe as their center, and all warmed by the waste heat of the smoke-pipe, these ventilating shafts having no communication with each other throughout their entire length.

By placing a small stove in the bottom of the ventilating shaft (in the basement), the smoke-pipe in the center of the ventilating shaft can be heated and the ventilating system kept in active operation without warming the school-rooms, even in the hottest weather.

The fresh-air flue, *a. a.*, is represented double, so that fresh air can be secured, whatever is the direction of the wind. Each extremity of the fresh-air flue should be provided with a valve to open or close the flue, and thus regulate the influx of cold air even when very high winds prevail. The handles of these valves will be in the school-room, so that the teacher can open or close the valves and thus control the flow of air without leaving the room. The teacher alone should have control of these valves. The air to feed the fire in the stove should be drawn from the school-room, and thus assist in ventilating the room.

ALPHABETICAL INDEX.

O.

P.

R.

S.

T.

U.

V.

W.